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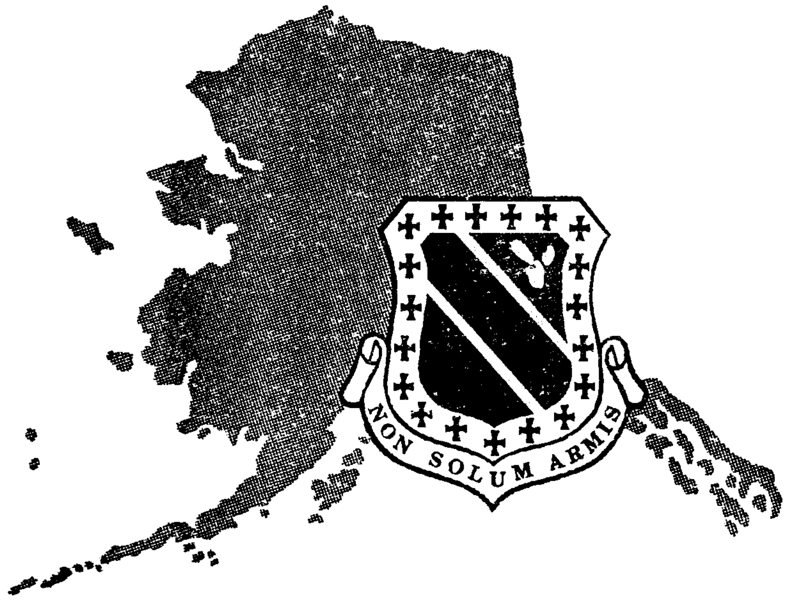

UNITED STATES AIR FORCE
ELMENDORF AIR FORCE BASE, ALASKA

ENVIRONMENTAL RESTORATION PROGRAM

OPERABLE UNIT 3
RECORD OF DECISION

FINAL

JANUARY 1997

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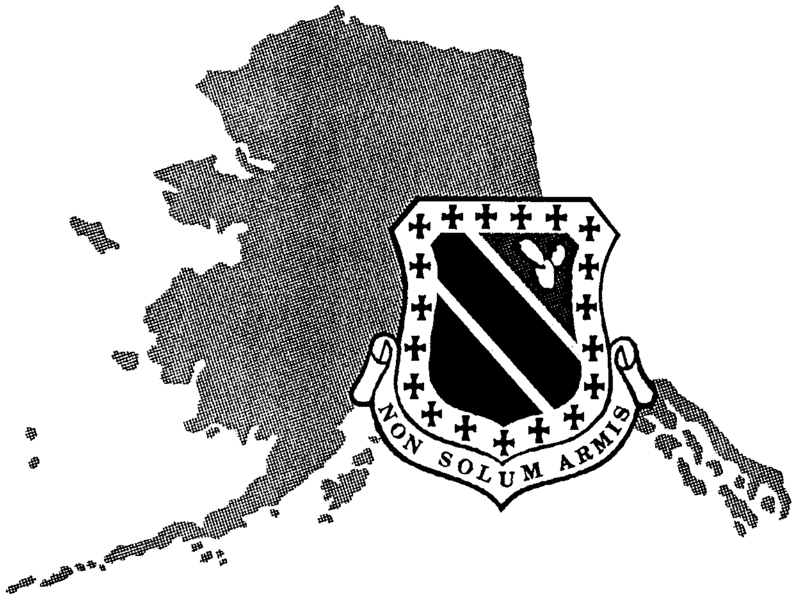

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PART I.
DECLARATION

SITE NAME AND LOCATION

Elmendorf Air Force Base (AFB)
Operable Unit (OU) 3
Elmendorf Air Force Base, Alaska

STATEMENT OF BASIS AND PURPOSE

This Record of Decision (ROD) presents the selected remedial action for OU 3 at Elmendorf AFB. It was developed in accordance with the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA) as amended by the Superfund Amendments and Reauthorization Act of 1986 (SARA), 42 U.S.C. §9601 et seq., and, to the extent practicable, in accordance with the National Oil and Hazardous Substances Pollution Contingency Plan (NCP), 40 CFR §300 et seq. The attached administrative record index (Appendix A) identifies the documents upon which the selection of the remedial action was based. The U.S. Air Force (USAF), the U.S. Environmental Protection Agency (USEPA), and the State of Alaska, through the Alaska Department of Environmental Conservation (ADEC), concur with the selected remedy.

ASSESSMENT OF THE SITE

Contaminant concentrations in OU 3 soil and shallow-aquifer groundwater were compared with risk-based criteria and interim remediation goals. As a result, the contaminant of concern (COC) identified at OU 3 is polychlorinated biphenyls (PCBs) at site SS21. Risks for soil at SD31, SD16, and Cherry Hill Ditch are within an acceptable range and resulted in no further action decisions for the soil at SD31, SD16, and Cherry Hill Ditch. The risks for groundwater beneath OU 3 are above maximum contaminant levels (MCLs) however; institutional controls exist at the base for the shallow aquifer and groundwater monitoring of selected wells located within OU 3 is included as part of OU 5 groundwater monitoring. Therefore, action is not required for groundwater under this ROD. The institutional control against use of shallow groundwater at the base is through the Elmendorf Air Force Base Facility Board.

Actual or threatened releases of PCBs from SS21 at OU 3, if not addressed by implementing the response action selected in this ROD, could present an imminent or substantial endangerment to public health, welfare, or the environment.

DESCRIPTION OF THE SELECTED REMEDY

The selected remedy was chosen from many alternatives as the best method of addressing the PCB contaminated soil at site SS21. It addresses the risks to health and the environment caused by the hypothetical exposure of a future resident to contaminated soils. The selected remedy addresses this risk by reducing soil contamination to below cleanup levels established for OU 3. The PCB concentrations found at SS21 are below levels regulated by the Toxic Substances Control Act (TSCA).

The selected remedy is excavation and off-site disposal of soil at SS21 containing PCBs greater than 5 ppm. The specific components of the selected remedy consist of the following:

- To protect human health, a chain link fence will be used to temporarily restrict access to the contaminated soil at SS21 until the soil has been removed and disposed off-site;

- All soil with PCB concentrations in excess of 5 ppm will be excavated and shipped to a disposal facility in the lower 48 which is acceptable for disposal of CERCLA waste under the Off-Site Disposal Rule (40 CFR 300.440);

- Confirmation sampling will be performed to ensure cleanup goals have been met;

- The sampling and removal of PCB soils at SS21 is expected to be accomplished within one field season; and

- After cleanup, site SS21 soil will be available for unrestricted use. As a requirement of previously signed RODs for Elmendorf Air Force Base, institutional controls have been established to restrict the use of the shallow aquifer in the outwash plain on the base.

STATUTORY DETERMINATIONS

The selected remedy is protective of human health and the environment, complies with federal and state requirements that are legally applicable or relevant and appropriate to remedial action, and is cost-effective. This remedy utilizes permanent solutions and alternative treatment technologies to the maximum extent practicable. However, because treatment of the contaminants at the site was not found to be practicable, this remedy does not satisfy the statutory preference for treatment as a principle element.

LEAD AGENCY ACCEPTANCE
OF THE RECORD OF DECISION,
ELMENDORF AIR FORCE BASE, OPERABLE UNIT 3

This signature sheet documents U.S. Air Force acceptance of the Record of Decision for Operable Unit 3 at Elmendorf Air Force Base.

Eugene D. Santarelli

EUGENE D. SANTARELLI, Lt Gen, USAF
Chairman, HQ PACAF
Environmental Protection Committee

3 JAN '97
Date

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LEAD AGENCY ACCEPTANCE

OF THE RECORD OF DECISION,

ELMENDORF AIR FORCE BASE, OPERABLE UNIT 3

This signature sheet documents United States Environmental Protection Agency acceptance of the Record of Decision for Operable Unit 3 at Elmendorf Air Force Base.

Chuck Clarke 12-5/91

CHUCK CLARKE
Regional Administrator
Region X
U.S. Environmental Protection Agency

Date

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SUPPORT AGENCY ACCEPTANCE

OF THE RECORD OF DECISION,

ELMENDORF AIR FORCE BASE, OPERABLE UNIT 3

The Alaska Department of Environmental Conservation concurs with the Record of Decision for Operable Unit 3 at Elmendorf Air Force Base.

for Lynn J. Tomich Kent 12/9/96

KURT FREDRIKSSON Date
Director, Spill Prevention and Response
Alaska Department of Environmental Conservation

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PART II.
DECISION SUMMARY

This Decision Summary provides an overview of the problems posed by the contaminants at Elmendorf Air Force Base (AFB) Operable Unit (OU) 3. It identifies the areas considered for remedial response, describes the remedial alternatives considered, and analyzes those alternatives compared to the criteria set forth in the National Contingency Plan (NCP). The Decision Summary explains the rationale for selecting the remedy, and how the remedy satisfies the statutory requirements of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA).

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Section 1.0
SITE NAME, LOCATION, AND DESCRIPTION

The following subsections describe the physical description, land use, and hydrogeology of OU 3, as well as groundwater use.

1.1 Physical Description

Elmendorf AFB is located approximately two miles north of downtown Anchorage (Figure 1-1). It is bordered to the north and west by the Knik Arm, to the east by Fort Richardson Army Post, and the south by a light industrial area and land owned by the Alaska Railroad Company. The base provides defense for the United States through surveillance, logistics, and communications support. OU 3 is located in the southwest quarter of Elmendorf AFB, on relatively flat terrain at an approximate elevation of 150 feet above sea level. OU 3 consists of three source areas and one receptor area (Figure 1-2). The source areas include: a former shop waste disposal site (SD16), the former polychlorinated biphenyls (PCB) transformer storage area (SS21), and a dry well at an aircraft maintenance hangar (SD31). Site SD52 (Cherry Hill Ditch) is not considered a source of contamination but did receive water runoff from the eastern portion of the base.

Source Area SD16 - Former Shop Waste Disposal Site

Source SD16 is composed of an open, grassy field north of Building 31-260, south of the west ramp (Figure 1-2). This source area was a location where waste solvents were disposed in earthen trenches. Due to regrading and revegetation of part of the source area, the former disposal trenches no longer exist. The northern portion of this source area serves as a place to stockpile snow during the winter and the eastern half of SD16 is used for heavy equipment storage.

Source Area SS21 - Former PCB Transformer Storage Area

Source SS21 is the site of former Building 31-357, which served as a storage building for PCB transformers in the 1970's. The site is located north of Nutmeg Boulevard and west of Elm Street (Figure 1-2). The buildings have been demolished; however, two concrete pads remain. One concrete pad and the loading dock were removed in 1996 as part of a sampling program.

Cherry Hill Ditch

Cherry Hill Ditch (SD52) is an artificial drainage channel which flows westward from the east-west runway at Elmendorf AFB toward the Knik Arm of the Cook Inlet. The ditch is used to direct surface water to the bluff above Knik Arm (Figure 1-2). Downstream of the ditch, a 30-inch pipe discharges water at approximately 200 gallons per minute. The source of the water carried in the ditch includes subsurface drains located under the runway and various buildings on the base, and a large portion of the storm water runoff from the eastern half of the base.

Source SD31 - Hangar 5 Dry Well

Source SD31 is located on the southern part of the base, north of Second Street and east of Elm Street (Figure 1-2). In the past, floor drains within the building discharged to a dry well located on the northeast side of the building. This dry well was removed in July 1993 by excavating the well and the surrounding soil. At present, the site is covered with an asphalt pad.

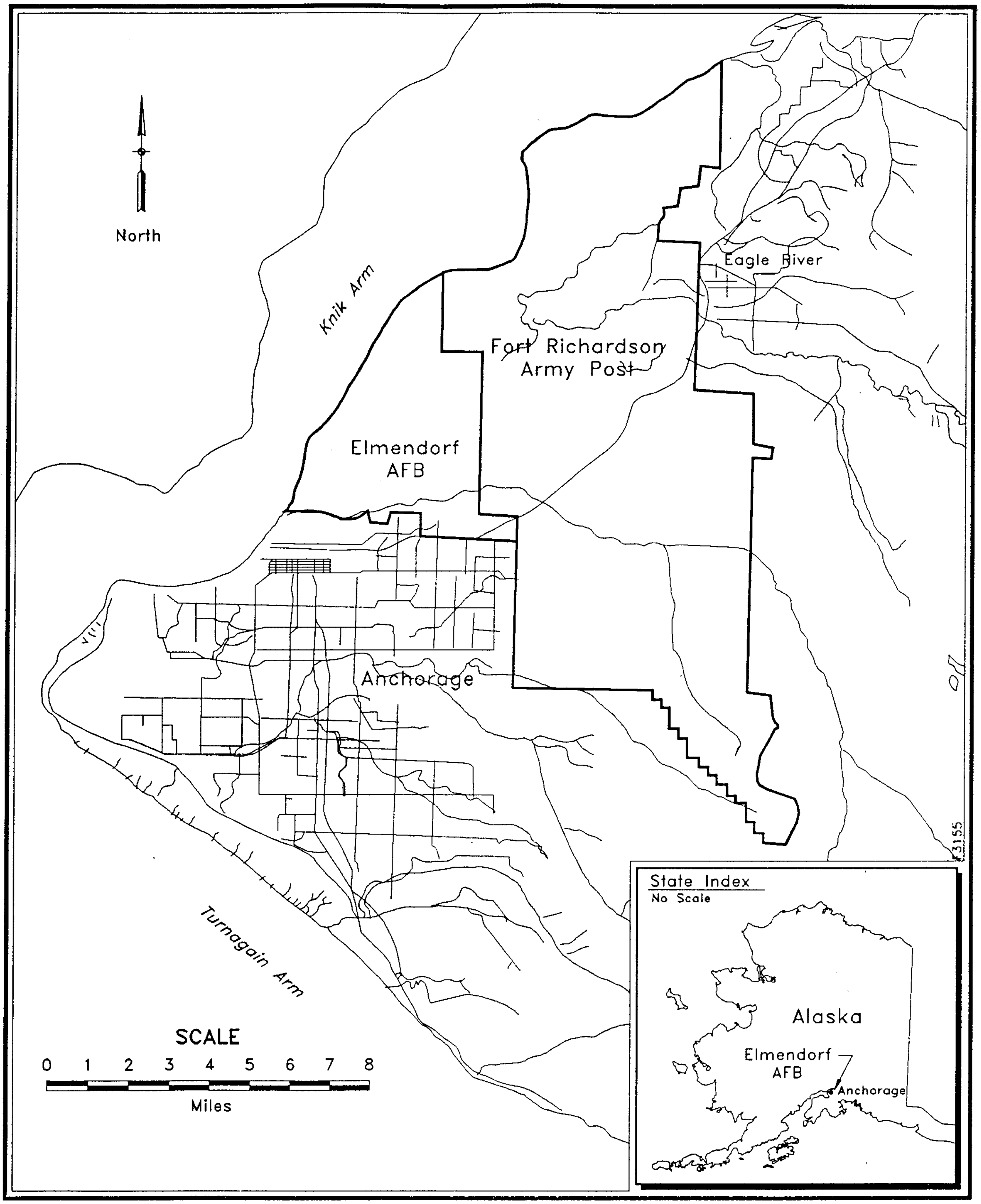

Figure 1-1. Site Location Map, Elmendorf AFB, AK

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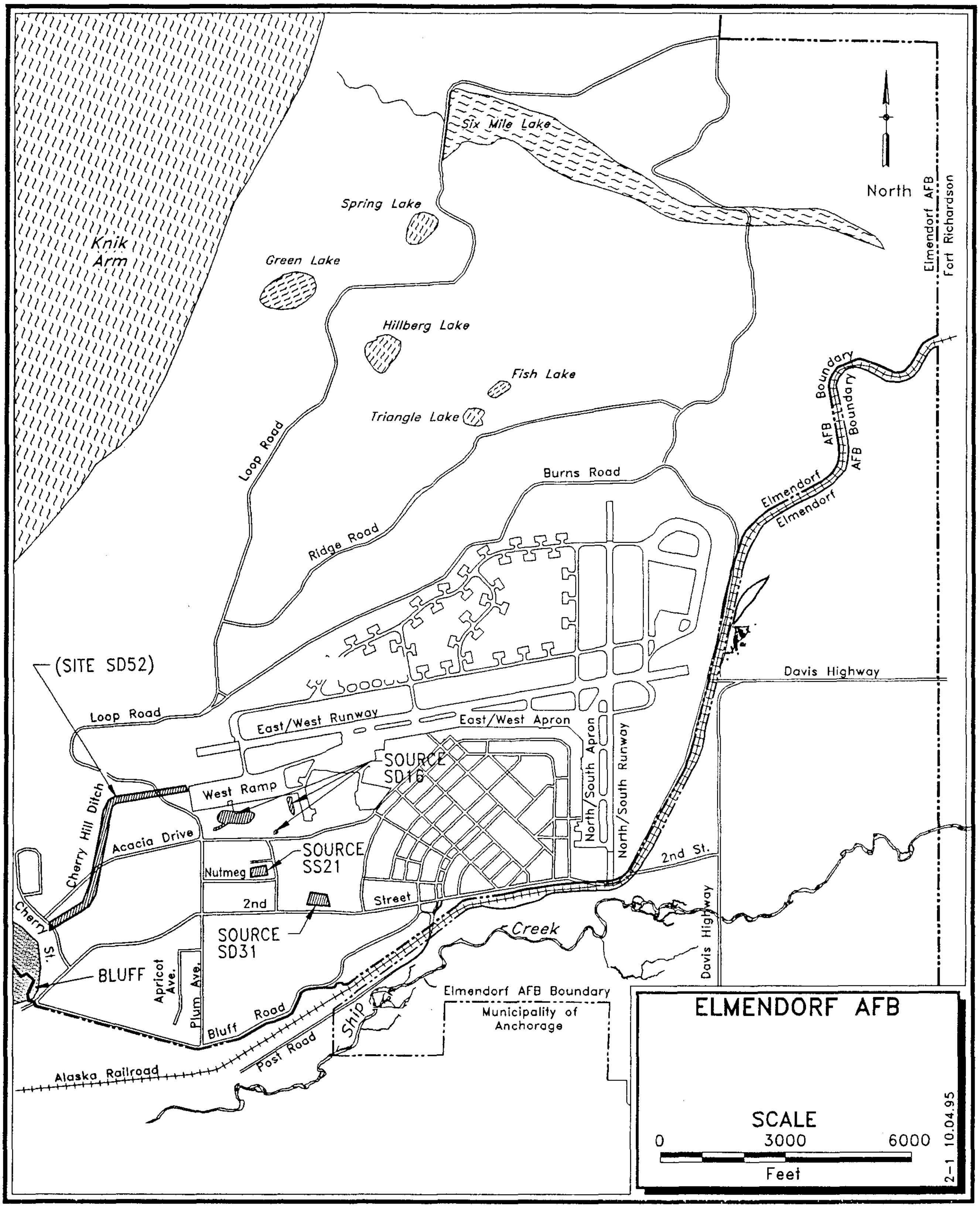

Figure 1-2. Location of OU 3 Study Area, Elmendorf AFB, AK

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1.2 Land Use

Land use for OU 3 includes base housing, maintenance, and equipment facilities. This includes equipment storage, hangars, and snow melt accumulation areas. Other land uses include designated outdoor recreation and open areas. The Base Master Comprehensive Plan has designated that present land use will continue in the future. There are no wetlands, flood plains, or endangered species in OU 3.

1.3 Hydrogeology and Groundwater Use

The OU 3 study area is located in the glacial outwash plain portion of the base. The surface sediments at OU 3 are typical of glacial deposits and consist predominantly of sand and gravel with locally substantial amounts of silt. The outwash deposits are coarser grained (sands and gravels) in the eastern portion of OU 3 and become more fine grained (sand, silts, and clays) in the western portion of the operable unit.

Underlying the shallow glacial deposits is the Bootlegger Cove Clay Formation. This formation, sometimes referred to as the "blue clay", consists of interbedded silt and clay deposits. The depth to the top of the Bootlegger Cove Clay Formation, although locally variable, is generally greatest in the northern portion of the base, becoming shallower toward the south and southeast. The formation is exposed at the bluff along the Knik Arm and occurs within OU 3 at a depth of up to 50 feet and is approximately 40 feet thick.

There are two aquifers underlying OU 3, an unconfined shallow aquifer and a deep confined aquifer. The aquifers are separated by the Bootlegger Cove Clay Formation (Figure 1-3). The Bootlegger Cove Clay Formation serves as an aquitard separating the shallow and deep aquifers. The shallow aquifer intersects the ground surface at some locations on the base, resulting in ponds, lakes, or bogs. The depth to saturation in the aquifer varies from zero to approximately 50 to 60 feet along the heights of the Elmendorf Moraine (north of OU 3). At OU 3, the depth to the top of the water table ranges from 5 to 35 feet below the surface.

Groundwater flow in the shallow aquifer is to the south-southwest at OU 3 toward Ship Creek. In the northern portion of OU 3, the groundwater gradient is approximately 69 feet per mile. In the southern portion of OU 3, the gradient steepens to approximately 111 feet per mile. The hydraulic conductivity for the shallow aquifer ranges from 0.1 to 0.3 centimeter/second. The transmissivity for the aquifer ranges from 17,000 to 45,000 feet^2/day, and linear velocity is approximately 3.2 feet/day. The water in the shallow unconfined aquifer at OU 3 is not used for any purpose on base.

The deep aquifer consists of sand and gravel outwash deposits and is present at depths ranging from 50 to 470 feet below the surface at OU 3. The groundwater in the deep aquifer flows regionally toward Knik Arm in a west to northwest direction. The deep aquifer supplies large quantities of water for light industrial use such as air conditioning cooling water and washing aircraft and vehicles. There are three active base wells screened in the deep aquifer at OU 3 that were sampled during the remedial investigation. Drinking water at the main base comes from Ft. Richardson. Water from the base wells, screened in the deep aquifer, is used for drinking water for emergency purposes only. Contamination resulting from OU 3 operations was not found in the base wells.

A hydraulic communication test between the shallow unconfined and deep confined aquifers conducted at Operable Unit 2 (OU 2) is applicable to OU 3 due to the similarity of lithology between the operable units. OU 2 is located adjacent to OU 3 to the northwest. Results from this test indicate that no communication exists between the two aquifers. Based on the results of this test, combined with seismic work performed at OU 3, as well as analytical sampling of base water supply wells screened in the deep

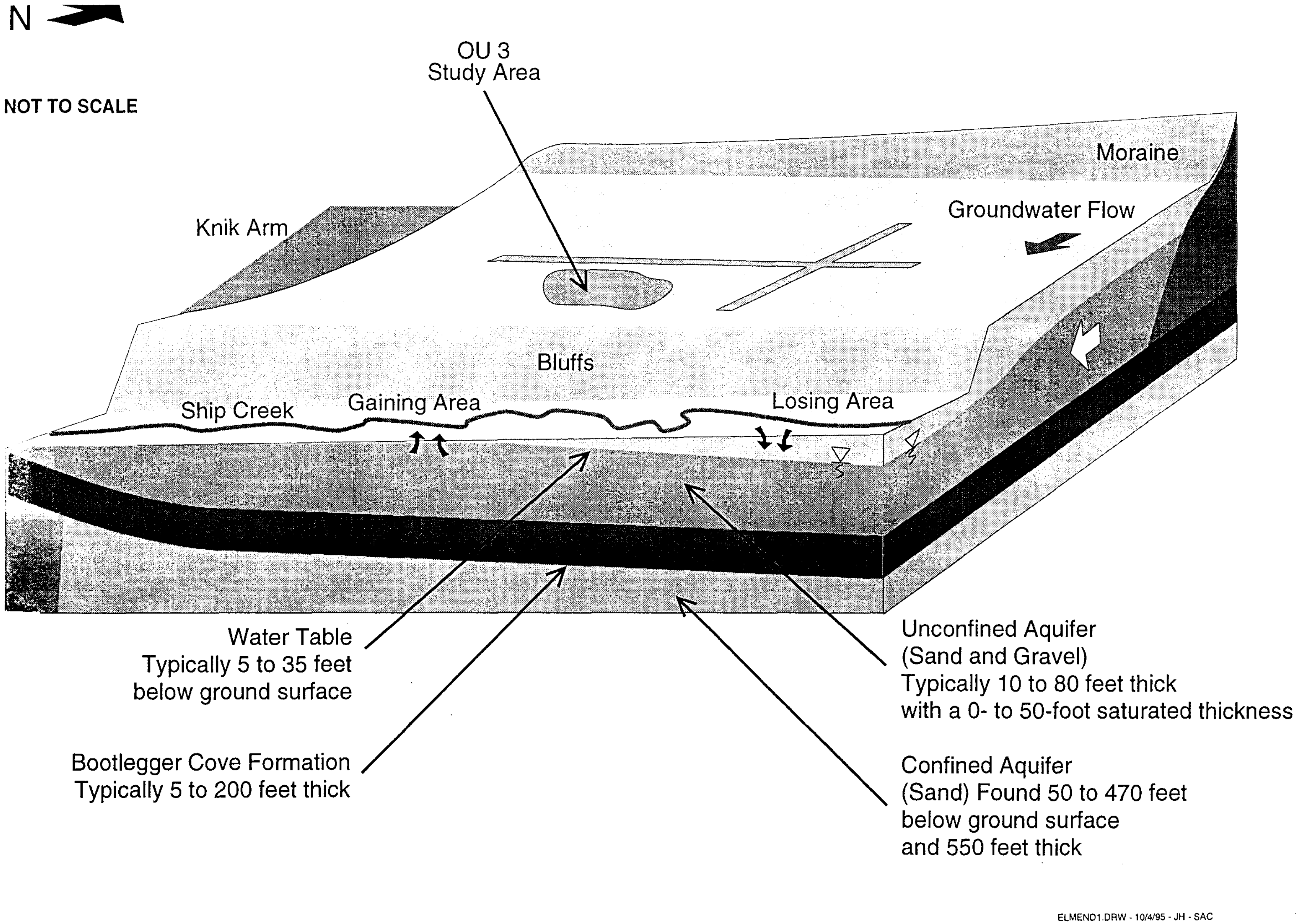

Figure 1-3. Hydrogeologic Conceptual Model

aquifer, the Bootlegger Cove Clay Formation is believed to be a barrier for movement of groundwater between the two aquifers.

Section 2.0
SITE HISTORY AND ENFORCEMENT ACTIVITIES

The following subsections detail the contaminant history of OU 3, the regulatory and enforcement history, the role of the response action, and the role of the community in defining the response.

2.1 Identification of Activities Leading to Current Contamination at OU 3

As part of the ongoing mission at Elmendorf Air Force Base, shop facilities, storage buildings, and hangars located within OU 3 are used to support base operations. These facilities have been in operation for over 30 years. OU 3 consists of three source areas and Cherry Hill Ditch, which serves as a receptor to potential contamination migrating from the eastern portions of the base.

SD16 is composed of an open, grassy field near Building 31-260 that was used in the 1950s and 1960s to dispose of shop wastes. Presently, the eastern portion of the area is occupied by heavy equipment and the northern portion is used to stockpile snow during the winter. The disposal of shop wastes no longer occurs at the site and any source of contamination has been removed.

The area encompassing SS21 includes concrete pads, formerly the location of Building 31-357. This area was used as a storage site for PCB oil containing transformers during the 1970s. The area is no longer used to store transformers.

SD31 is in the vicinity of Hangar 5/Building 32-060 and was used for general storage and workshop space. It was reported that products used in the building were discharged into floor drains which connected to a dry well. A dry well located on the northeast side of the building was used for disposal of sewer-derived waste and later designated SD31. Discharge into the floor drains no longer occurs and the dry well has been removed.

As mentioned above, Cherry Hill Ditch is an artificial drainage channel which flows westward from the east-west runway toward Knik Arm. The area from the boundary with SD16 to the western boundary of the base was originally designated as SD52. However, due to its current role in receiving and channeling water runoff from the eastern portion of the base, the ditch was reclassified from a source area to a receptor in 1993.

Environmental investigations have been conducted at OU 3 since the early-1980s. Several studies discovered evidence of contamination in various parts of OU 3. The majority of these investigations were broadly focused across Elmendorf AFB and covered only portions of the source areas currently included in OU 3.

The first investigation to examine contamination at OU 3 was conducted by Engineering-Science in 1983. The study was Phase I of the Installation Restoration Program (IRP) process and had the objective of identifying potential environmental contamination associated with past disposal practices. A Phase II Work Plan was also developed by Engineering-Science in 1983. In 1986 and 1987, Dames & Moore performed Phase II, Stage 1 and Stage 2 investigations at OU 3. A Resource Conservation and Recovery Act (RCRA) Facility Assessment was conducted by the Alaska Department of Environmental Conservation (ADEC) in 1988 and consisted of a preliminary review and a visual site inspection of potential source areas. Also in 1988, Harding Lawson conducted an IRP Phase II, Stage 3 investigation at OU 3. IRP Phase III, Stage 3 and 4 studies were conducted by Black & Veatch in 1990. A Limited

Field Investigation Work Plan and Draft Report was performed by CH2M Hill in 1992. In the summer of 1993, a full scale Remedial Investigation (RI) was conducted by Radian Corporation. The RI determined the nature and extent of contamination and the potential risks to public health and the environment. The results were compiled and analyzed in an RI report. Alternatives for remedial action were evaluated in detail in the OU 3 Feasibility Study (FS), submitted with the RI in March of 1995.

The RI/FS concluded that low levels of soil contamination at the source areas were primarily the result of vehicular traffic, road paving, and pesticide application. PCB contamination present at one site was the result of transformer storage. Limited shallow-aquifer groundwater contamination by solvents and fuel related products was the result of disposal in open ditches and the spilling or leaking related to underground storage tanks.

2.2 Regulatory and Enforcement History

Based on the results of environmental investigations, Elmendorf AFB was listed on the National Priorities List by the U.S. Environmental Protection Agency (USEPA) in August 1990. This listing designated the facility as a federal site subject to the remedial response requirements of the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA), as amended by the Superfund Amendments and Reauthorization Act of 1986 (SARA). On November 22, 1991, the U.S. Air Force (USAF), the USEPA, and ADEC signed the Federal Facilities Agreement (FFA) for Elmendorf AFB. The contaminated areas of Elmendorf AFB were divided into seven OUs, each to be managed as a separate region and investigated according to varying schedules.

In accordance with the FFA, the RI of OU 3 was conducted in the summer of 1993. The RI was intended to investigate all possible past sources of contamination at OU 3, including past CERCLA and RCRA sites. The RI determined the nature and extent of contamination and the potential risks to public health and the environment. The results were compiled and analyzed in the RI Report.

During the RI investigation, a dry well and surrounding soil was removed at SD31. After the RI was completed, a portion of Cherry Hill Ditch was reconstructed to regrade the ditch and remove soil contamination. An enclosed storm drainage system was installed.

The Final RI/FS was submitted in March 1995. A Proposed Plan was distributed to the public on June 20, 1995, and a public meeting to discuss the plan was held on July 12, 1995. At that time, the identified preferred alternative was bioremediation. The USAF, USEPA, and ADEC agreed to a treatability study to determine the effectiveness of this treatment alternative. The treatability study was conducted during the Spring 1996 and demonstrated that the treatment would not reduce PCB concentrations and could not achieve the soil cleanup goals. In July 1996, additional sampling was performed at Source Area SS21 in order to further define the area of contamination and aid in the selection of a feasible remedy from the alternatives identified in the Proposed Plan. Included in the sampling program was the removal of one concrete pad and loading dock at the site and the collection of surface and subsurface soil samples. Analytical results of the sampling confirmed the findings of the remedial investigation conducted in 1993. The index of documents entered into the Administrative Record for OU 3 is provided as Appendix A.

2.3 Role of Response Action

This ROD is one of six RODs to be completed at Elmendorf Air Force Base. RODs have already been completed and signed for OUs 1, 2, 4, and 5. The OU 3 and OU 6 RODs are expected to be completed in 1996. Operable Unit 7 source areas are included in the OU 6 ROD.

The CERCLA process described above is intended to identify solutions to contamination issues where they exist. The remedial action described in this ROD addresses threats to human health and the environment posed by contamination at OU 3. The RI/FS Report defines these threats as both shallow-aquifer groundwater and soil contaminants. Soil with contaminants that pose a potential threat to the public will be removed, transported, and disposed in an appropriate facility. As a requirement of previously signed RODs for Elmendorf Air Force Base, institutional controls have been established to restrict the use of the shallow aquifer in the outwash plain on the base. These restrictions are enforced through the Base Comprehensive Plan. Projects and other activities are reviewed during the planning stage to ensure compliance with the Base Comprehensive Plan. In addition, construction projects and other activities also undergo an environmental review. This review helps ensure compliance with groundwater use restrictions.

2.4 Community Participation

Public participation has been an important component of the CERCLA process at Elmendorf AFB in general, and at OU 3 specifically. Activities aimed at informing and soliciting public input regarding OU 3 include:

- **Environmental Update:** *Environmental Update* is a newsletter distributed to the community and interested parties. It discusses the progress that has been made on operable units and advises the public about opportunities to provide input concerning decisions to address contaminated areas of the base. Aspects of the OU 3 CERCLA progress have been published in this newsletter.

- **Community Relations Plan:** The base environmental personnel maintain and regularly update a Community Relations Plan. It describes how the base will inform the public of base environmental issues and it solicits public comment on base environmental programs.

- **The Restoration Advisory Board/Technical Review Committee:** Base personnel meet regularly with representatives of the community to discuss base environmental programs and solicit their comments.

- **Public Workshops:** On February 5, 1992, approximately 75 people attended a public workshop where base personnel discussed base environmental programs and encouraged public participation.

- **Public Meeting:** A public meeting was held in January 1994 at the Aurora School to present the plans for reconstruction of Cherry Hill Ditch.

- **Videotape:** Base personnel made a videotape describing base environmental activities. The tape is shown to base employees as well as the general public.

- **Speakers Bureau:** The 3rd Wing Public Affairs Office maintains a speakers bureau capable of providing speakers versed in a variety of environmental subjects to military and civic groups.

- **Newspaper Releases:** News releases are published on significant events during the IRP. News releases are made announcing all public meetings that are held to discuss proposed remedial actions.

- **Information Repositories:** Public access to technical documents is provided through information repositories located at the Bureau of Land Management's Alaska Resources Library and the University of Alaska Anchorage's Consortium Library. The information in the repositories is also maintained in the administrative record. The remedial action was selected based on the information held in the administrative record.

- **Display Board:** During public functions, a display board, showing key elements and progress of the Elmendorf AFB IRP, is used to communicate technical issues to the public. It is used during both on-base and off-base events.

- **Proposed Plan:** The OU 3 Proposed Plan was distributed to the public on June 20, 1995; a public meeting was held July 12, 1995; and the public review period was from June 20 to July 21, 1995. Comments from the public are contained in Part III-Responsiveness Summary of this document.

- **Public Notice:** Public notices have been issued prior to all significant decision points in the IRP. For OU 3, public notice was issued for the Proposed Plan in the *Anchorage Daily News* (June 18, 1995) and the *Sourdough Sentinel* (June 15, 1995).

- **Mailing List:** A mailing list of parties interested in the restoration program is maintained by the base. Notices and publications (news releases, including the OU 3 Proposed Plan meeting) are released via the mailing list.

- **Responsiveness Summary:** Public comments were received on the OU 3 Proposed Plan. The USAF maintains a record of all comments and has published responses to the comments in this Record of Decision.

All decisions made for OU 3 were based on information contained in the Administrative Record. An index to the documents contained in the Administrative Record for OU 3 is provided as Appendix A.

Section 3.0
SITE CONTAMINATION, RISKS, AND AREAS REQUIRING RESPONSE ACTIONS

This section summarizes soil contamination at OU 3 and identifies the areas which may require remedial action. One area was identified for response action based on the risk that contaminants pose to human health and the environment. The basis of this analysis is the data collected during the Remedial Investigation (RI) which identified the nature and extent of contamination in OU 3.

There are three source areas (SD16, SD31, and SS21) and one receptor (Cherry Hill Ditch) at OU 3. Soil contamination is discussed below in terms of five geographic areas, including: source SD16, source SS21, the east intersource area, Cherry Hill Ditch, and the west intersource area. The locations of these areas are shown in Figure 3-1. Shallow-aquifer groundwater contamination is discussed for two areas of interest: the OU 3 east groundwater area (geographically containing source areas SD16, SS21, and the east intersource area) and the OU 3 west groundwater area (geographically containing Cherry Hill Ditch and the west intersource area). The locations of these shallow-aquifer groundwater areas are shown in Figure 3-2.

Groundwater modeling was conducted as a part of the Operable Unit 5 (OU 5) investigation. The modeling included a study of contaminant movement within groundwater across several operable units at the base, including OU 3.

3.1 Nature and Extent of Contamination

During the RI, samples of soil, sediment, and shallow-aquifer groundwater were collected and analyzed for organic and inorganic constituents. Contaminants detected in the soil, sediments, and shallow-aquifer groundwater include fuel products, volatile organic compounds (VOCs), semi-volatile organic compounds (SVOCs), inorganic compounds, polychlorinated biphenyls (PCBs), and pesticides.

A detailed discussion of the determination of contaminants of potential concern (COPCs) is included in the OU 3 RI/FS Report (USAF, 1994). A list of the COPCs for OU 3 is included in Appendix B of this ROD. In summary, COPCs were determined by statistically comparing site analytical results with background/upgradient results available for the same constituents. Chemicals retained as COPCs are those which were measured on-site at concentrations significantly above background/upgradient concentrations of the same chemicals. Once COPCs were statistically established, the list was further refined by removing affected analytes associated with analytical methods that were determined to be non-representative of site conditions (within the range of background concentrations), and analytes which had results that were all below instrument-specific detection limits and were not second-column confined. The refined list of COPCs was then subjected to a conservative, residential land use risk-based screening procedure during which maximum analyte concentrations were compared with risk-based concentrations associated with: a) a systemic hazard quotient of 1.0; b) a lifetime incremental cancer risk of 10^{-6} for water; and c) a lifetime incremental cancer risk of 10^{-7} for soil. This risk-based screen helped to produce a list of COPCs which were most likely to contribute significantly to the risks associated with OU 3. Gasoline, diesel, and kerosene did not undergo the rigorous statistical evaluations made on the individual compounds but were retained as COPCs.

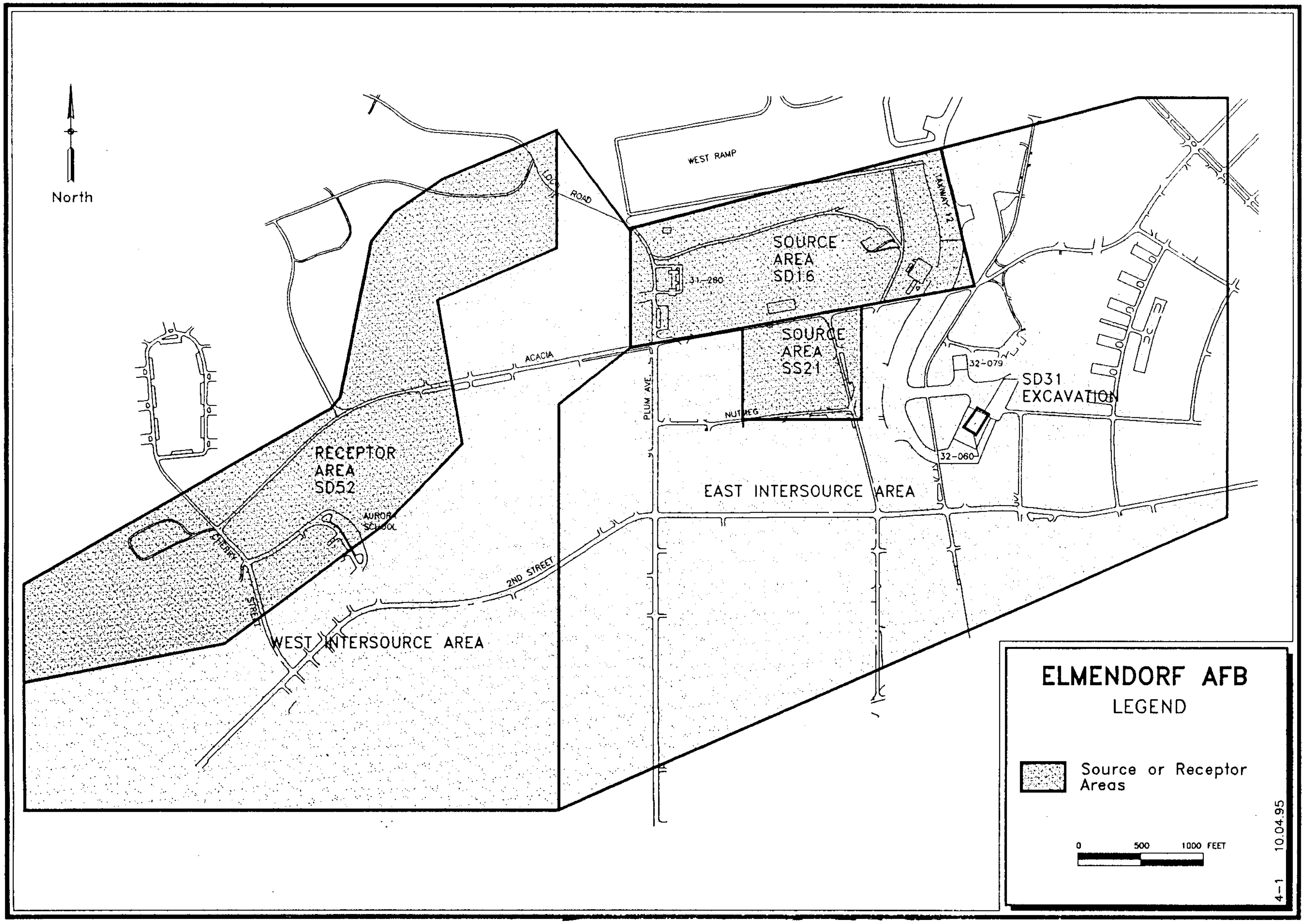

Figure 3-1. Soil Areas of Interest at OU 3, Elmendorf AFB, AK

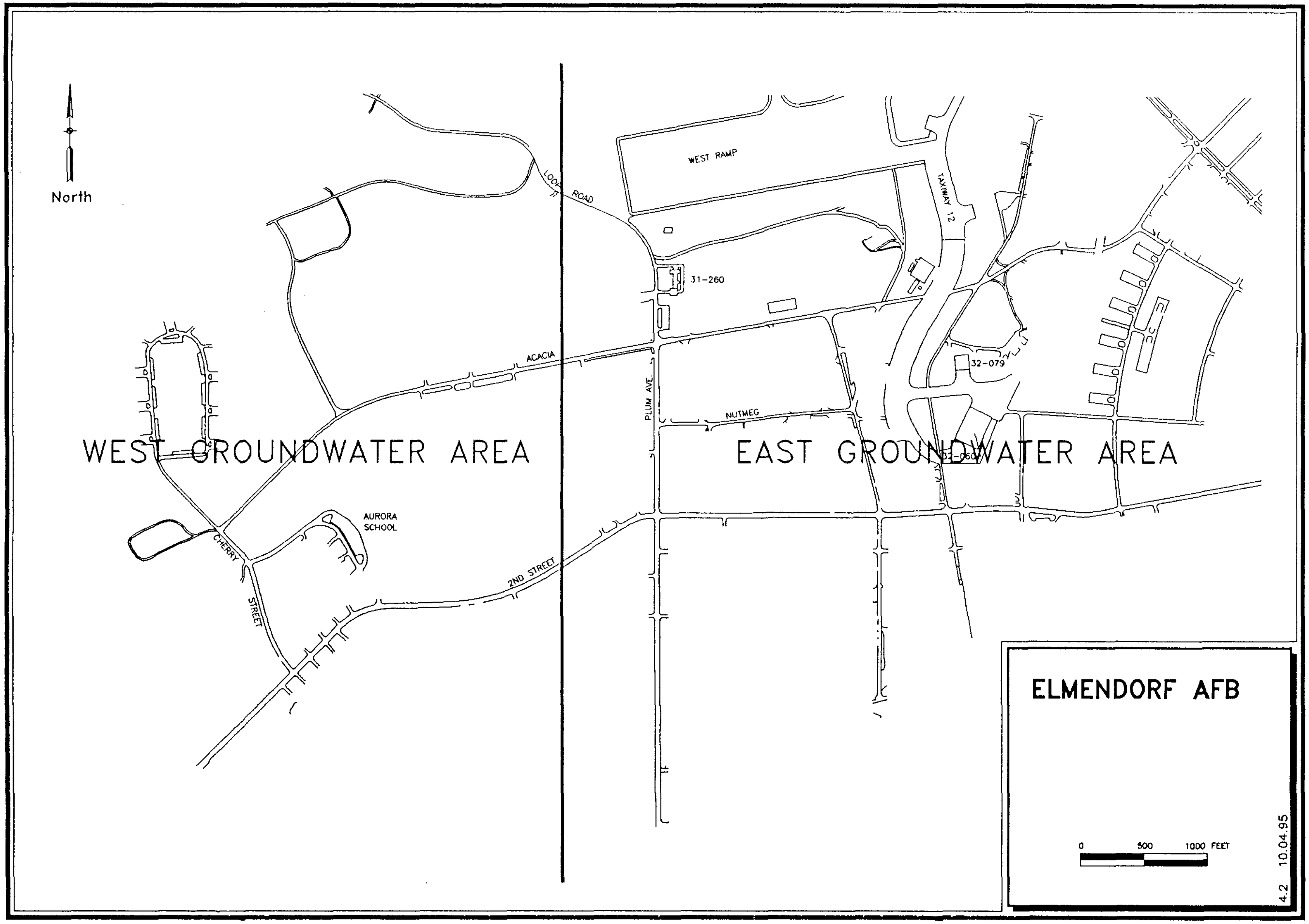

Figure 3-2. Groundwater Areas of Interest at OU 3, Elmendorf AFB, AK

3.1.1 Soil and Sediment

Soil data from OU 3 was evaluated by area based on surface and subsurface contaminant occurrences. Sediment samples were collected at SD16 and Cherry Hill Ditch in areas where surface runoff had deposited sediment. Contaminant migration into the subsurface soil from contaminant sources is believed to be almost vertical due to the coarse, porous nature of the soil at OU 3.

Source SD16 Soil and Sediment Results

Several potential sources of contamination were identified at source SD16. These include a snow melt runoff area, former solvent disposal trenches, heavy equipment storage and maintenance activities, and potential fuel-related leaks from spills or near underground storage tanks. As a result of present practices, the sources do not constitute an ongoing contamination threat. Contamination in the soil at SD16 includes low levels of VOCs and SVOCs, generally within depths of 5 to 6 feet below the surface. Metals and pesticides were also identified in soil and /or sediment samples.

The constituents found in the soil and sediments at SD16 were evaluated in a risk assessment which is described in Section 3.3. Tables 3-1 and 3-2 list constituents found in the soil and sediment at SD16 that were major contributors to risk. A complete list of constituents is included in the RI/FS report for OU 3 (March 1995).

Source SS21 Soil Results

The results of the remedial investigation at source SS21 verified that PCBs are the principal soil contaminants in this area. The most likely potential source of this contamination is leaks of PCB oil from electrical transformers. Transformers are no longer stored at the site. Low levels of VOC and SVOC contamination observed frequently in association with PCB contamination may also be related to the transformer oils. Pesticides are present across the site as well as across the base. In addition, isolated levels of arsenic and lead were detected at SS21. The metals may also be related to the transformer oils.

A treatability study was performed in 1996 on soil from SS21 to determine whether a bioremediation technology would be effective in reducing the total PCB concentrations in soil and concrete to less than 5 ppm. The bench scale study failed to demonstrate that PCB levels in either soil or concrete could be reduced to the target level. An original concentration of 30 ppm PCBs was reduced less than 18% (to approximately 24 ppm).

Also in 1996, a concrete pad and loading dock were removed from SS21 to facilitate additional soil sampling activities. The removed concrete was designated investigation derived waste and since it contained levels of PCBs greater than 50 ppm, it was classified as a Toxic Substances Control Act material and disposed at a facility in the lower 48 which accepts CERCLA waste under the Off Site Disposal Rule.

The additional sampling further defined the area at SS21 impacted by PCB contamination. Two concrete pads remain at the site. These remaining pads were sampled for PCB contamination and results show levels at or below 1.0 ppm PCBs.

The constituents in the soil at SS21 were evaluated in a risk assessment which is described in Section 3.3. Table 3-1 lists constituents in the soil at SS21 that were major contributors to risk. A complete list of constituents is included in the RI/FS report for OU 3 (March 1995).

Table 3-1

Summary of Soil Contamination/Guidelines at Operable Unit 3
Elmendorf AFB, AK

Soil Location	Contaminant of Concern	Maximum Concentration (in parts per million)	Frequency of Detection (total hits/total samples)	Guidelines[a] (in parts per million)
SD16	PAHs (benzo(b)fluoranthene)	15.5	22/31	0.88
	Diesel	130	2/40	2000[b]
SS21	PCBs (PCB-1260)	27.6	15/16	5[c]
	Arsenic	26[e]	10/10	7.04[d]
East Intersource Area	PAHs (benzo(a)pyrene)	0.137	4/7	0.088
SD52 (Cherry Hill Ditch)	Diesel	130	11/11	2000[b]
	PCBs (PCB-1260)	4.15	2/3	5[c]
	PAHs (benzo(b)fluoranthene)	24.9	3/11	0.88
	Arsenic	90.9[e]	11/11	7.04[d]

[a] RCRA Subpart S levels were originally used for screening in the Feasibility Study and Proposed Plan. However, the RCRA levels are 8 years old and no longer used for the CERCLA program. Instead, slightly more stringent risk-based screening levels developed by EPA Region 3 have been used for screening.
[b] State of Alaska cleanup level D for underground storage tanks.
[c] This level is the cleanup goal for OU 3 and is based on a site specific risk evaluation for PCBs. It is comparable to the risk of 1 ppm recommended in EPA Superfund guidance for unrestricted residential use. A discussion on how the level was determined is included in Section 4.2 of this ROD.
[d] Arsenic levels exceed EPA Region 3 risk-based screening levels. Due to high local background levels and the lack of any identified source of arsenic on base, the background level was used.
[e] Result is for only one location. All other arsenic results for OU 3 are much lower and are in the range of naturally occurring concentrations.

Table 3-2

Summary of Surface Water and Sediment Contamination/Guidelines at Operable Unit 3 Elmendorf AFB, AK

Sediment	Contaminant of Concern	Maximum Concentration (in parts per million)	Frequency of Detection (total hits/total samples)	Guidelines[a] (in parts per million)
SD16	PAHs (benzo(a)pyrene)	3.01	2/2	0.088
	Pesticides (4,4-DDD)	4.03	1/1	1.9
SD52 (Cherry Hill Ditch)	PCBs (PCB-1260)	8.63	22/43	No Established Guideline
	Pesticides (heptachlor epoxide)	.680	3/43	0.07
	PAHs (benzo(b)fluoranthene)	3.98	7/10	0.88
Surface Water[c]	**Contaminant of Concern**	**Maximum Concentration (in parts per billion)**	**Frequency of Detection (total hits/total samples)**	**Guidelines[a] (in parts per billion)**
West Intersource	Pesticides (4,4-DDT)	0.0562	2/2	0.2
	Copper	9.7	2/2	500
	Selenium	29.6	2/2	180
	Cadmium	3.46	2/2	18
	Lead	22	2/2	15[b]
	Cyanide	9.8	2/2	730

[a] RCRA Subpart S levels were originally used for screening in the Feasibility Study and Proposed Plan. However, the RCRA levels are 8 years old and no longer used for the CERCLA program. Instead, slightly more stringent risk-based screening levels developed by EPA Region 3 have been used for screening.
[b] USEPA Region 3 has not listed a risk based screening level for lead. Therefore, the level listed is from the Safe Drinking Water Act.
[c] Media investigated as surface water; however, actually represents storm water at the base.

East Intersource Area Soil Results

The east intersource area includes former source SD31, as well as additional pilot borings for monitoring wells which were installed in the eastern and southern portion of OU 3. The dry well and surrounding soil at SD31 were excavated in July of 1993. The dry well was found to be the repository of sewer-derived waste with a minor amount of petroleum compounds. After all the sewer waste and petroleum-impacted soil (measuring approximately 38 feet long, 22 feet wide, and 20 feet deep) was removed, soil samples were collected from the sides and bottom of the excavation to confirm that the contamination had been removed.

Very low levels of soil contamination were detected in the soil samples collected in the east intersource area. Low concentrations of VOCs were detected in confirmation samples collected after the dry well had been removed at SD31. Low levels of VOCs (including BTEX and solvent-type VOCs), as well as SVOCs, were also detected in the soil borings in the east intersource area. Pesticides and metals were also detected, but at low levels.

The constituents remaining in the soil at the east intersource area after the excavation was completed were evaluated in a risk assessment which is described in Section 3.3. Table 3-1 lists constituents at the east intersource area that were major contributors to risk. A complete list of constituents is included in the RI/FS report for OU 3 (March 1995).

Receptor SD52 (Cherry Hill Ditch) Soil and Sediment Results

Soil and sediment contamination was found in Cherry Hill Ditch during the remedial investigation. The predominant contaminants were PCBs and pesticides. Cherry Hill Ditch receives runoff from the east-west runway as well as other areas on the eastern half of the base. The most likely source of the contamination is the surface runoff of contaminated water and deposition of contaminated particles migrating downstream from other parts of the base through the storm water system.

At Cherry Hill Ditch, elevated PCB and pesticide concentrations were detected south of the intersection of the ditch with Acacia Street. The highest level of PCBs detected at Cherry Hill Ditch was in the sediments at 39.4 mg/kg. Ethylbenzene and xylene were the primary VOCs detected. Elevated concentrations of diesel, kerosene, polynuclear aromatic hydrocarbons (PAHs, or PNAs), and phthalates were also detected in surface soil and sediment samples. Most of the locations where these contaminants were detected coincided with the PCB occurrences. Among the inorganic constituents; arsenic, lead, manganese, and zinc were detected.

From May to July of 1994, after the RI investigation was completed, the section of Cherry Hill Ditch between Acacia Drive and Cherry Street was reconstructed to regrade the ditch area and install an enclosed storm drainage system. The area of reconstruction is shown in Figure 3-3. A portion of the ditch approximately 10 feet long (along the flow line), two feet wide, and thirty inches deep was excavated around the sediment sample with the highest PCB contamination. After the soil was removed, samples were collected from the surrounding sediment to confirm that the area of highest contamination was removed. Sample results after excavation ranged from 3.38 to 8.63 mg/kg PCB-1260. These sample results were included in the evaluation of current risk at the site.

A new 36-inch diameter high density polyethylene (HDPE) storm drain, approximately 1,900 feet in length, was installed parallel to Cherry Hill Ditch. This new drain carries storm water from the outlet of existing drains just south of Acacia Drive to an existing storm drain vault just north of Cherry Street. A 100-foot long, 12-inch diameter HDPE storm drain was installed in the ditch to drain

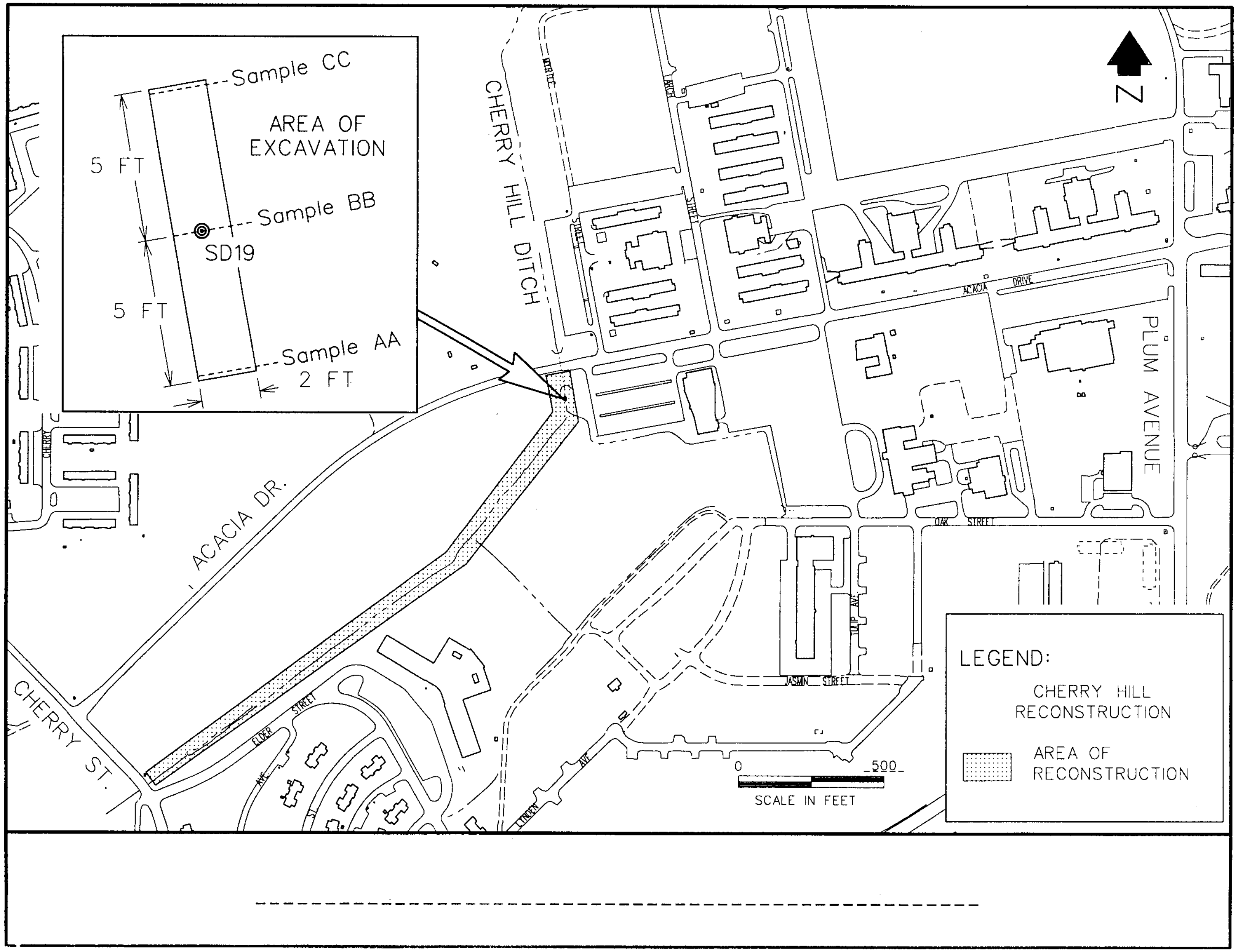

Figure 3-3. Location of Excavation and Reconstruction at Cherry Hill Ditch, Elmendorf AFB, AK

water from just south of sample location SD19 to the inlet of the 36-inch pipe. The bottom of the existing ditch was lined with an erosion control fabric. The ditch was then filled with a layer of unclassified fill, a layer of drain rock, and 2 to 4 inches of topsoil. During times of normal surface water flow, discharge will continue to flow in the former ditch area that has been filled with drain rock. The HDPE storm drain will carry overflow during episodes of high discharge.

The sediment remaining in place at Cherry Hill Ditch is no longer considered sediment since it is beneath the surface. The PCBs are not expected to be mobile and any pathways to reasonable exposure have been eliminated. The constituents remaining in the soil at Cherry Hill Ditch were evaluated in a risk assessment which is described in Section 3.3. Tables 3-1 and 3-2 list constituents remaining that were major contributors to risk. A complete list of constituents is included in the RI/FS report for OU 3 (March 1995).

West Intersource Area Soil Results

Soil samples were collected during the drilling of groundwater monitoring wells in the west intersource area. In general, very little contamination was identified in the soil in this area of OU 3. The contaminants detected are consistent with low levels of VOCs, SVOCs, and metals that are common across OU 3. The observed contamination is likely the result of runoff from nearby parking lots, vehicular activity, or the deposition of fugitive dust. The constituents found in the soil at the west intersource area were evaluated in a risk assessment which is described in Section 3.3. A complete list of constituents is included in the RI/FS report for OU 3 (March 1995).

3.1.2 Groundwater

Shallow-aquifer groundwater contamination is discussed for two areas: the OU 3 east groundwater area (geographically containing source areas SD16, SS21, and the east intersource area) and the OU 3 west groundwater area (geographically containing Cherry Hill Ditch and the west intersource area). Isolated contaminants were detected in the shallow aquifer in groundwater wells at OU 3. The contamination was found in several wells but at low concentrations and no groundwater plumes could be identified at the OU 3 source areas. As indicated in Section 1.3, samples collected from base wells screened in the deeper aquifer do not indicate that contamination exists resulting from OU 3 operations.

OU 3 East Groundwater Results

Benzene, trichloroethene (TCE), dichloroethene (DCE), and tetrachloroethene (PCE) were detected in the shallow aquifer in wells in the OU 3 east groundwater area. Sources for these compounds could include the former earthen disposal trenches, heavy equipment storage and maintenance activities, and leaks or spills in the vicinity of underground storage tanks at SD16.

Table 3-3 lists a summary of highest detections of contaminants found in the shallow aquifer in the OU 3 east groundwater area. The majority of the detections are associated with TCE and other halogenated VOCs, which also exceeded potential regulatory levels. Although TCE and benzene were found in 70% and 50% of the wells respectively, they are at very low levels (less than MCLs in most wells). The first sampling event occurred at the beginning of the field program before most of the wells were installed. All wells were sampled in events 2 and 3.

Table 3-3

Summary of
Shallow-Aquifer Groundwater Contamination/Guidelines at Operable Unit 3
Elmendorf AFB, AK

Location	Contaminant of Concern	Maximum Concentration (in parts per billion)	Frequency of Detection (total hits/total samples)	Guidelines[a] (in parts per billion)
East Intersource Area (includes Sites SD31, SD16, SS21)	TCE	140	26/36	5
	PCE	9.37	2/36	5
	Benzene	6.17	18/36	5
	Methylene chloride	6.43	1/35	5
	bis(2-ethylhexyl)phthalate	1,150	5/35	6
	Cadmium	25.6	17/36	5
	Lead	26	29/36	15
West Intersource Area (includes Site SD52)	bis(2-ethylhexyl)phthalate	520	7/21	6
	Cadmium	7.4	5/21	5

[a] For this table, the Primary Federal Drinking Water Standard Maximum Contaminant Levels are used.

OU 3 West Groundwater Area Results

To characterize the depth to the top of the water surface of the shallow aquifer in the southern portion of OU 3 and thus to fill basewide hydrogeologic gaps, three groundwater monitoring wells were installed in the west intersource area. In addition, six wells were installed adjacent to Cherry Hill Ditch to determine the relationship between the ditch and the shallow aquifer.

Several VOCs were detected in shallow-aquifer groundwater samples including chloroform, chloromethane, 1,1,1-trichloroethane, trichloroethene, and trichlorofluoromethane. Isolated occurrences of bis(2-ethylhexyl)phthalate were observed intermittently in samples. Cadmium and vanadium were the only inorganic COPCs detected in the shallow-aquifer groundwater samples.

Table 3-3 lists the levels of the highest detections of contaminants in the shallow aquifer in the OU 3 west groundwater area.

3.2 Groundwater Modeling

Groundwater flow in the shallow aquifer at OU 3 is to the south, toward OU 5, where several sensitive receptors are present: Ship Creek, beaver pond wetland areas, drainage ditches, and seeps. The OU 5 groundwater modeling report, which included modeling of basewide groundwater contamination over the next 30 years, predicts that organic contaminants within the shallow aquifer at OU 3 will naturally attenuate before reaching Operable Unit 5. Therefore, OU 3 is not expected to have an impact to sensitive receptors.

3.3 Risk Evaluation

Based on the concentrations of contaminants detected during the RI, human health and environmental risk assessments were performed to determine if areas should be considered for remedial action. All concentrations of contaminants, including all potential contaminants of concern, whether exceeding potential regulatory levels or not, were included in the risk assessment. At Cherry Hill Ditch and SD31, the constituents remaining in the soil after completion of the removal actions were included in the risk assessment. Since soil was not removed from SS21 (only concrete), the highest soil PCB results were included in the risk assessment.

Human Health Risk Assessment (HRA)

By determining under what land use conditions people are potentially exposed to what chemicals, for how long, and by what pathways of exposure, the cancer and noncancer risks were determined in the RI/FS.

Exposed Populations and Exposure Pathways -- Listed below are five possible exposure pathways to contamination. Details on the parameters used in the Health Risk Assessment are shown on Table 3-4.

- **Future On-Site Resident:** The HRA evaluated exposure of residents to contaminated surface soil through direct contact (incidental ingestion and dermal absorption) and inhalation of dusts. Their exposure to shallow-aquifer groundwater through ingestion, inhalation (showering), and dermal contact (showering) was also evaluated.

- **Future On-Site Worker:** The HRA evaluated exposure of workers to contaminated subsurface soil through direct contact (dermal absorption and incidental ingestion) and inhalation of vapors from the soil. Ingestion of on-site water was also evaluated.

- **Current On-Site Worker:** The HRA evaluated exposure of workers to contaminated surface soil through direct contact (incidental ingestion and dermal absorption) and inhalation of dusts.

- **Construction Worker:** The HRA evaluated exposure of short term construction workers to contaminated subsurface soil through direct contact (incidental ingestion and dermal absorption) and inhalation of dusts.

- **Hypothetical Visitor:** The HRA evaluated exposure of an adult and child visitor to contaminated surface soil through direct contact (incidental ingestion and dermal absorption) and inhalation of dusts.

Exposure Assumptions -- Risk can be calculated both for the average exposure and the reasonable maximum exposure (RME) of the population. All chemicals detected during sampling were evaluated as potential sources of cancer and noncancer health risks. In the case of metals, risks were only calculated if the metals concentrations exceeded background concentrations. Background metals concentrations in groundwater were collected by the U.S. Geological Survey (USGS) in the Anchorage Bowl area and compiled in the *Elmendorf Air Force Base, Basewide Background Sampling Report* (USAF, 1993). These metals data have been used historically at Elmendorf AFB for comparison with on-site groundwater metals concentrations. Confidence intervals of the USGS data mean for a given metal were compared with confidence intervals for the OU 3 analytical results for the same analyte. If the confidence intervals of the two means overlapped, the two means were considered not to be different and the particular metal was removed from consideration as a COPC. Based on this evaluation, all

Table 3-4

Exposure Assumptions for OU 3, Elmendorf AFB, AK

Parameters	Hypothetical On-Site Residential				On-Site Occupational		Construction Worker	Visitor	
	Adult		Child		Current	Hypothetical		Adult	Child
	RME	Average	RME	Average	RME	RME	RME	RME	RME
Body Weight (kg)	70[a]	70[a]	15[a]	15[a]	70[a]	70[a]	70[a]	70[a]	15[a]
Exposure Duration (yrs)	30[a]	9[b]	6[d]	6[d]	25[a]	25[a]	1[c]	30[c]	6[c]
Averaging time (carcinogens) (yrs)	70[d]	70[d]	N	NA	70[d]	70[d]	70[d]	70[d]	70[d]
Averaging time (noncarcinogens) (yrs)	NA	NA	6[d]	6[d]	25[d]	25[d]	1[d]	30[d]	6[d]
Total inhalation rate (m^3/day)	20[d]	20[d]	16[c]	16[c]	20[d]	20[d]	20[d]	20[d]	16[c]
Soil Ingestion/Contact									
Soil Ingestion Rate (mg/day)	200/100[b]	100[b]	200/100[b]	100[b]	50[a]	50[a]	480[a]	200/100[b]	200/100[b]
Soil to Skin Adherence Factor (mg/cm2)	1[f]	.02[f]	1[f]	0.2[f]	1[f]	1[f]	1[f]	1[f]	1[f]
Exposed Skin	5000[b]	1900[b]	3900[b]	1900[b]	3160[f]	3160[f]	3160[f]	5000[b]	1900[b]
Exposed Frequency (days/yr)	185[g]	110[g]	185[g]	110	SS[h]	185[g]	40[c]	12[c]	12[c]
Exposure Duration (yrs)	24/6[b]	9[b]	24/6[b]	6	—	—	—	24/6[b]	24/6[b]
Water Use									
Water Ingestion (L/day)	2A[a]	1.4[c]	.07[c]	0.419	NA	1[a]	NA	NA	NA
Indoor Inhalation Rate (m^3/day)	15[a]	15[a]	12[c]	12	NA	NA	NA	NA	NA
Exposure Frequency (days/yr)	350[a]	275[a]	350[a]	275	NA	250[a]	NA	NA	NA
Skin Surface (cm^2)	23000[f]	20000[f]	10,600[f]	8,660	NA	NA	NA	NA	NA
Shower Duration (min)	15[f]	10[f]	15[f]	10	NA	NA	NA	NA	NA

[a] USEPA. Risk Assessment Guidance for Superfund - Volume I - Human Health Evaluation Manual, Supplemental Guidance. Interim Final Report, Office of Emergency and Remedial Response, Washington, D.C., 1991.
[b] USEPA. Supplemental Guidance for Superfund Risk Assessments in Region X. EPA 910/9-91-036, August 23, 1991.
[c] The construction worker scenario evaluates deep soil risk.
[d] USEPA. Risk Assessment Guidance for Superfund - Volume I - Human Health Evaluation Manual, Part A. Interim Final Report. Office of Emergency and Remedial Response, Washington, D.C., December 1989.
[e] USEPA. Exposure Factors Handbook. Office of Health and Environmental Assessment, Washington, D.C., 1989.
[f] USEPA, Dental Exposure Assessment: Principles and Applications. Interim Report. Office of Health and Environmental Assessment, Washington, D.C., January 1992.
[g] Barnack, K. Personal Communications, 1994
[h] Site Specific

NA - Not applicable.
RME - Reasonable Maximum Exposure.

metals in groundwater at OU 3 were determined to be at background concentrations. The USGS mean concentrations used for the comparisons are the following for the metals in question:

- Antimony: 0.002 mg/L
- Arsenic: 0.029 mg/L
- Lead: 0.028 mg/L
- Manganese: 6.81 mg/L

Average exposure risks were assessed using the measured concentrations at the site. RME risks were assessed using the 95% upper confidence limit (UCL) of the arithmetic mean concentration in soil and shallow-aquifer groundwater.

Conservative assumptions were used to avoid underestimating risk (Table 3-4). For example, the HRA assumed that future residents would live where the contaminants are located for 30 years and they would drink and shower with the contaminated, shallow-aquifer groundwater. This is a highly conservative assumption since the primary land use of the OU 3 area is not conducive to residential development and military personnel typically reside on-base for only 3 to 8 years. Snow and ice cover the ground for part of the year which reduces the exposure to the soil. To account for this, an average exposure of 110 days was used in the risk assessment. In addition, the shallow aquifer is not used for drinking water and is unlikely to be used as a water supply in the future because of its poor yield relative to the deep, confined aquifer.

Using exposure levels and standard values for the toxicity of contaminants, excess lifetime cancer risks (ELCRs) and hazard indices (HIs) were calculated to describe cancer and noncancer risks, respectively. The ELCR is the additional chance that an individual exposed to site contamination will develop cancer during his/her lifetime. It is expressed as a probability such as 1×10^{-6} (one in a million).

The HI estimates the likelihood that exposure to the contamination will cause some negative health effect. An HI score below one indicates that people exposed to the contamination will not experience at least one health effect. The HIs at OU 3 were all less than 1.

ELCRs and HIs were calculated using Reference Doses (RfDs) and Cancer Slope Factors (CSFs) which represent the relative potential of compounds to cause adverse noncancer and cancer effects, respectively.

Two sources of RfDs and CSFs were used for this assessment. The primary source was Integrated Risk Information System (IRIS) database, the USEPA repository of agency-wide verified toxicity values. If a toxicity value was not available through IRIS, then the latest available quarterly update of the Health Effects Assessment Summary Tables (HEAST) issued by the USEPA's Office of Research and Development was used as a secondary source. For some chemicals detected at OU 3, no toxicity value from IRIS or HEAST was available, and toxicity values were provided by EPA Region X as provisional RfDs and cancer slope factors.

Table 3-5 summarizes the carcinogenic human health risks calculated for OU 3. The risks are based on hypothetical exposure to soil and shallow-aquifer groundwater. The shallow groundwater aquifer is not presently used and will not be used in the future for supplying potable or non-potable water. For carcinogenic soil risk, the calculated results for the future resident (RME), which evaluate surface soil risks, are listed for SD16, SS21, east and west intersource areas, and the groundwater areas. The construction worker scenario results, which evaluates subsurface soil risk, is provided for Cherry Hill Ditch.

Table 3-5

Summary of Health Risks at Operable Unit 3, Elmendorf AFB, AK

Site	Soil Risk[a]	Major Contributors and Percentage of Contribution
Source SD16	5.3×10^{-5}	Benzo(a)pyrene (34%) Arsenic (31%) Benzo(b)fluoranthene (5%)
Source SS21	1.1×10^{-4}	Arsenic (24%) PCB-1260 (71%)
East Intersource Area	1.0×10^{-6}	Benzo(a)pyrene (98%)
Receptor SD52[b]	9.9×10^{-7}	PCB-1260 (44%) Arsenic (25%) Benzo(a)pyrene (17%)
West Intersource Area	1.9×10^{-7}	Arsenic (98%)
Site	**Groundwater Risk[a]**	**Major Contributors and Percentage of Contribution**
OU3 East Groundwater (Shallow Aquifer)	3.0×10^{-5}	Chloroform (5%) bis(2-ethylhexyl)phthalate (53%) Trichloroethene (32%)
OU3 West Groundwater (Shallow Aquifer)	2.1×10^{-5}	Chloroform (25%) bis(2-ethylhexyl)phthalate (75%)

Note: Risks presented are for carcinogenic health risks at OU 3. Non-carcinogenic risks were examined; however, all were determined to be less than 1 (i.e. HIs were less than 1).

[a] Risks are calculated under the most conservative scenario which is excess cancer risks conservatively assumed for 30 years of exposure by future residents (Reasonable Maximum Exposure).

[b] The risks at receptor SD52 are calculated under the most likely scenario which is that of a construction worker in contact with subsurface soils. This risk is calculated as excess cancer risks conservatively assumed for 1 year of exposure during on-site construction work.

The presence of PCBs in the soil at SS21 resulted in a risk of 1.1×10^{-4}. This risk occurs for a future 30-year resident, the most conservative scenario. For all the other areas at OU 3, the risk is below 10^{-6} or within the range of 10^{-5} to 10^{-6}. Risks did not exceed 1×10^{-4} in groundwater at OU 3. This risk is based on future residents drinking and bathing with the shallow-aquifer groundwater in the area for 30 years.

In order to determine a cleanup level for PCBs at SS21, a risk evaluation was performed using the same conservative assumptions. Under site conditions, a cleanup level of 5 ppm PCBs was determined to be comparable to the EPA standard default risk of 1 ppm (EPA PCB superfund guidance for unrestricted residential use). This means that if SS21 contains less than 5 ppm PCBs, the site will be available for unrestricted use.

Risks were calculated using assumptions regarding exposure pathways and the time receptors were exposed to the contaminants. Each exposure was estimated in a conservative manner. Risk management decisions were made considering the uncertainty in the assumptions used in the risk assessment. At OU 3, the shallow groundwater is not used and is not expected to be used in the future, so existing risks and potential risks are significantly less than the worst-case risk.

Ecological Risk Assessment (ERA)

The ERA was performed to determine if the reported concentrations of chemicals or calculated exposures to plants and wildlife at OU 3 are likely to produce adverse effects. Ecological effects were evaluated quantitatively by calculating Ecological Quotients (EQs). EQs are defined as the ratio between measured concentrations or predicted exposures and critical effects levels. If an EQ is less than 1.0, the effect is unlikely to occur. Critical effects are defined in the selection of assessment and measurement endpoints. Assessment endpoints are the general environmental resource or value that is being protected. A measurement endpoint is a specific criterium that is used to evaluate the more general assessment endpoint.

Compared to undeveloped portions of the base, the sites that comprise OU 3 do not contain major ecological resources. The naturally occurring vegetation has been removed from most of the areas. The existing vegetation in the contaminated areas varies from barren to sparse grassy areas.

The moose, black-capped chickadee, masked shrew, merlin, peregrine falcon, and meadow vole were selected as indicator species for the ERA. Exposures to all indicator species were evaluated for surface soils at Cherry Hill Ditch. Only meadow vole exposures were evaluated for the other sources because it is the only indicator species that occurs regularly in these areas. The EQ of 1.0 was exceeded for meadow voles at SD16, SS21, east intersource area, and west intersource area; however, the upper threshold limit of the background concentrations would also exceed 1.0. This fact indicates that the modeled doses or reference criteria represent naturally occurring risks. In the case of selenium, the concentrations in the soil are likely to be biased high due to interferences in the analysis. At Cherry Hill Ditch, the EQ was exceeded for black-capped chickadee, masked shrew, and meadow voles before reconstruction of the ditch. Since the remaining contamination, after construction, is below the surface, it is unlikely that a significant population of these indicator species or other animals is threatened by the contaminants.

No significant impacts to plants or animals warranting action were determined to be present based on the results of the ERA.

Uncertainties Associated with the Risk Assessment

Risk assessments involve calculations based on a number of factors, some of which are uncertain. Some of the major assumptions and uncertainty factors associated with the risk assessment are the following:

- Constituent concentrations were assumed to be equal to the 95% Upper Confidence Limit (UCL), which is likely biased high (may overestimate risk).
- Existing concentrations are assumed to be the concentrations in the future. No reduction through natural degradation and attenuation over time is taken into account (may overestimate risk).
- No increase through additional contamination is assumed (may underestimate risk).

- Potential degradation products of existing organic contaminants are not considered (may overestimate or underestimate risk).

3.4 Summary

Actual or threatened releases of contaminants from OU 3, if not addressed by implementing the response action selected in this ROD, may represent an imminent and substantial endangerment to public health, welfare, or the environment.

Actions at Cherry Hill Ditch and SD31 resulted in the removal of contaminated soil from these source areas. The risks for soil at SD31, SD16, and Cherry Hill Ditch are considered acceptable and resulted in no further action decisions for the soil at SD31, SD16, and Cherry Hill Ditch. These sites are available for unrestricted use. The only contaminant of concern for soil at OU 3 is PCBs at SS21.

The risks for groundwater, based on both organic and inorganic concentrations, are acceptable. No current receptors exist for groundwater at the base due to institutional controls. The only potential receptor of groundwater is at OU 5 and this is addressed in the OU 5 ROD. For these reasons, it was determined remedial action is not required for groundwater at OU 3.

Section 4.0
REMEDIAL ACTION OBJECTIVES, ALTERNATIVES, AND COMPARATIVE ANALYSIS

The following subsections discuss the contaminants of concern (COCs) for OU 3 and present the site requiring remedial action. In addition, remedial action objectives are presented for OU 3, as well as a description of the various cleanup alternatives which were evaluated to achieve those remedial objectives. The results of the detailed comparison made between those alternatives are also presented.

4.1 Contaminants of Concern and Need for Remedial Action

COCs were developed from the results of the risk assessment. By comparing contaminant concentrations in soil with cleanup standards, risk-based criteria, and interim remediation goals, the COC for soil at OU 3 is PCBs at site SS21. Although other contaminants at other sites at OU3 exceeded interim remediation goals or action levels, the resulting risks were considered acceptable. The risks for soil at SD31, SD16, and Cherry Hill Ditch are considered acceptable and this resulted in no further action decisions for the soil at SD31, SD16, and Cherry Hill Ditch. These sites are available for unrestricted use. The presence of PCBs in the soil at SS21 results in an unacceptable risk and the need for remedial action.

Although organic constituents (e.g., TCE) are present above Maximum Contaminant Levels (MCLs) in the shallow groundwater aquifer beneath OU 3, the concentrations are generally low, there are no current receptors, and institutional controls at the base exist for the shallow aquifer to prevent use. Metals were also identified above MCLs; however, based on a comparison of metals concentrations in the shallow-aquifer groundwater beneath OU 3 and background concentrations, the metals were determined to be at or below background concentrations (Section 3.3).

All sources of groundwater contamination in OU 3 have been or will be addressed as a part of the remedial action at OU 3. No current receptors exist for groundwater at the base due to institutional controls. As a requirement of previously signed RODs for Elmendorf Air Force Base, institutional controls have been established to restrict the use of the shallow aquifer in the outwash plain on the base. These restrictions are enforced through the Base Comprehensive Plan. Projects and other activities are reviewed during the planning stage to ensure compliance with the Base Comprehensive Plan. In addition, construction projects and other activities also undergo an environmental review. This review helps ensure compliance with groundwater use restrictions. For these reasons, it was determined remedial action is not required for groundwater at OU 3.

The identification and screening of remedial technologies and the detailed analysis of alternatives was based on remediating PCBs in shallow soil at SS21. Figure 4-1 shows the approximate location of impacted soil at SS21.

4.2 Remedial Action Objectives and Goals

Specific remediation alternatives were developed and evaluated for PCBs at SS21. Remedial action objectives are:

- Protect human health and the environment by reducing the risk from the potential exposure to PCBs in surface soil;

- Clean up PCB-contaminated soil to below the established cleanup level;

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062221

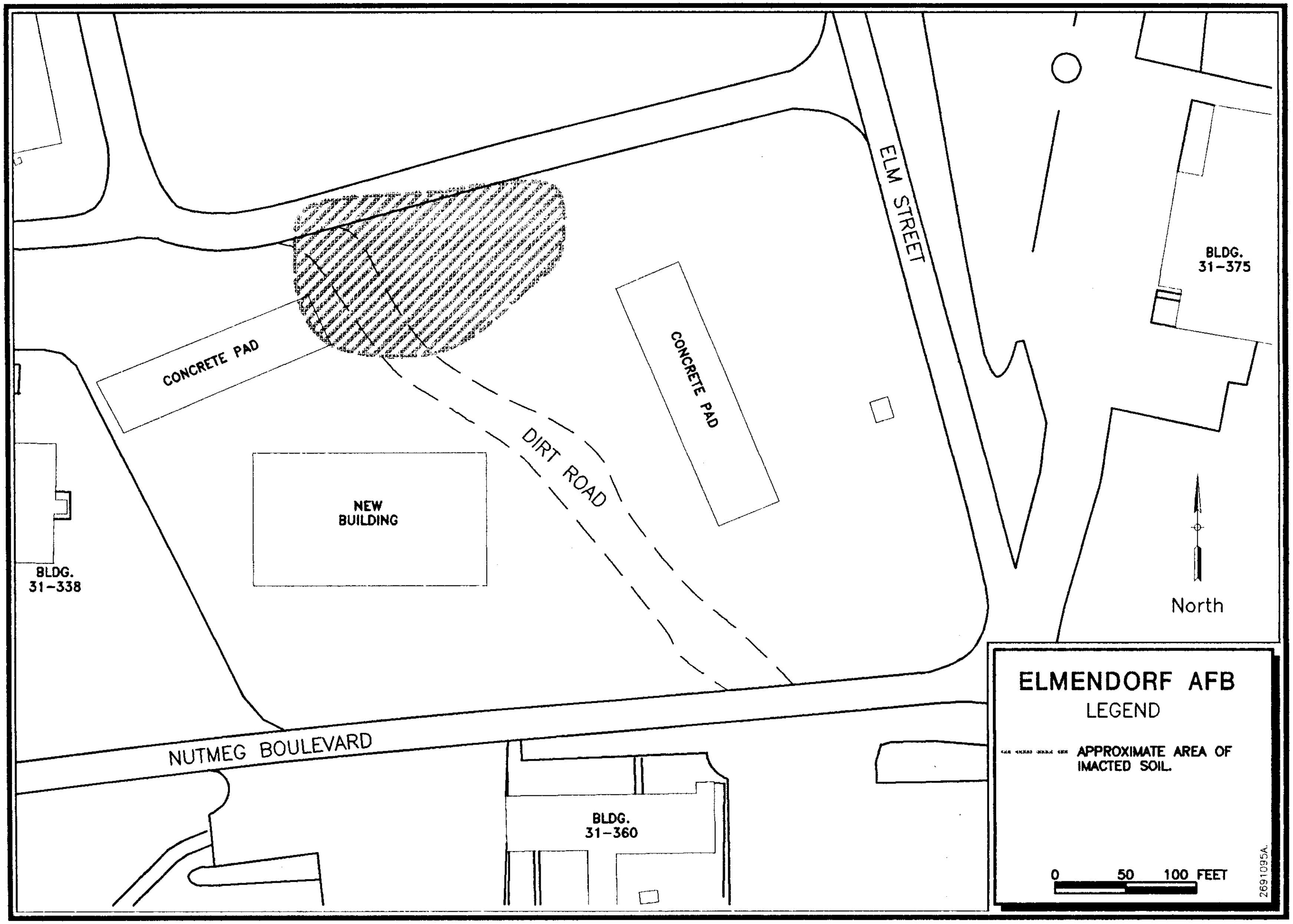

Figure 4-1. Approximate Area of Impacted Soil at Source Area SS21, Elmendorf AFB, AK

- Protect uncontaminated media during cleanup activities; and

- Restore contaminated media for future land uses.

The remedial action goal is to achieve a cleanup level of 5 ppm PCBs. The contamination is limited to soil only (single media), is at relatively low levels, is localized, is relatively immobile, and is nonvolatile in nature. A screening risk assessment was performed using the conservative, residential land use scenario. The exposure assumptions are listed in Table 3-4 and include the assumption that family housing will be built on the site. An average exposure of 110 days was used to account for the presence of snow and ice covering the ground for most of the year. Using the screening risk assessment, a level of 5 ppm PCBs was selected as the cleanup level for SS21 because it represents a risk which, based on site conditions, is comparable to the standard EPA Superfund PCB guidance level (1.0 ppm) for unrestricted residential use.

4.3 Alternatives

Remedial action alternatives were identified that specifically address soil contamination containing PCBs. Five remedial alternatives were identified to address the contamination scenario at SS21.

Alternative 1: No Action

Evaluation of this alternative is required by CERCLA as a baseline reflecting current conditions without any cleanup. This alternative is used for comparison with each of the alternatives. While natural processes should degrade and reduce the concentrations of the chemicals over time, PCBs are very stable and the timeframe to achieve cleanup levels is indefinite. This alternative does not include any long-term monitoring. There are no costs associated with this alternative.

Cost: None

Alternative 2: Capping

This alternative involves the installation of an asphaltic concrete cap over all soil contaminated above 5 ppm PCBs. The cap would cover approximately 1,000 square feet. A cap would eliminate the migration pathways and exposure pathways, thus protecting human health, plants, and animals. Because PCBs are very stable, the time required to achieve cleanup levels is indefinite. Maintenance actions, for example repaving and crack repair, would be required over the life of the cap to maintain effectiveness.

Cost: $568,000 (Includes 30 years of maintenance. Cost of maintenance will extend past 30 years for an indefinite period of time.)

Alternative 3: Excavation and Off-Site Disposal

For this alternative, all soil above the cleanup level (estimated to be 200 cubic yards) would be excavated and shipped to a disposal facility which is acceptable for disposal of CERCLA waste under the Off-site Disposal Rule (40 CFR 300.440). The cleanup level was determined to be 5 ppm based on a risk evaluation using site conditions. Clean soil would be backfilled to restore the original grade of the site.

The soil volume for this alternative was stated in the Proposed Plan (June 1995) to be 640 cubic yards. The cost indicated in the Proposed Plan was $671,000. The additional sampling performed at SS21 further delineated the area impacted by PCBs and resulted in a lower volume of impacted soil and a lower cost.

Cost: $170,000

Alternative 4: In-Situ Bioremediation

This alternative was included in the Proposed Plan (June 1995) as the preferred alternative and involves the degradation of PCBs through biological activity in the soil. All soil above the cleanup level (5 ppm) would be treated. Biological organisms and additives such as nutrients, water, and air would be added by mechanical spraying to maximize treatment effectiveness. A treatability study was performed in the spring of 1996 to determine if bioremediation would be effective at reducing the concentration of PCBs in the soil. The results of this study indicated that bioremediation is not an effective alternative for reducing the concentrations of PCBs at SS21. The study and results are presented in the biotreatability study final report (September 1996).

Cost: $181,000 (Includes treatability study.)

Alternative 5: Excavation and On-Site Treatment

This alternative was listed in the Proposed Plan (June 1995) as the contingency alternative and involves the excavation and on-site treatment of approximately 200 cubic yards of contaminated soil. All soil above the cleanup level (5 ppm) would be treated. An on-site treatment technology would be used for remediation such as soil washing or thermal desorption. The specific technology would be developed in the remedial design. A treatability study would be performed during the remedial design to determine necessary treatment procedures needed to achieve the cleanup levels. After the procedures have been defined, the contaminated soil would be excavated and processed through the treatment system; the treated soil would be backfilled on site. Any residuals left from the treatment would be properly disposed at a permitted disposal facility, if applicable.

The soil volume for this alternative was stated in the Proposed Plan (March 1995) to be 640 cubic yards. The additional sampling performed at SS21 further delineated the area impacted by PCBs and resulted in a lower volume of impacted soil. The cost was not significantly affected by the decrease in soil volume because of the large mobilization cost associated with this alternative.

Cost: $791,000

Costs and time to clean up for all alternatives are presented in Table 4-1.

Table 4-1

Cost and Duration for Remedial Alternatives

Alternative	Costs ($)			Time to Achieve Cleanup Goals (Years)
	Capital Cost	Annual Cost	Present Worth Cost*	
1: No Action	0	0	0	0
2: Capping	464,000	8,400	568,000	Indefinite
3: Excavation and Off-Site Disposal	170,000	0	170,000	1
4: In-Situ Bioremediation	181,000	0	181,000	a
5: Excavation and On-Site Treatment	791,000	0	791,000	1

* A discount rate of 7% was applied to annual costs in the present worth calculation.
[a] This alternative was evaluated in a treatability study and determined not to be effective in reducing PCB contamination in soil.

4.4 Summary of Comparative Analysis of Alternatives

The comparative analysis describes how each of the alternatives meet the CERCLA evaluation criteria relative to each other.

4.4.1 Threshold Criteria

Protection of Human Health and the Environment

All alternatives, except the No Action and In-Situ Bioremediation alternatives, are protective of human health and the environment. Alternative 2, capping, would provide protection because contaminants would be inaccessible to the public due to their presence under the cap. Soil would not be removed, so disposal concerns and short-term exposure would be minimal. However, Alternative 3, Excavation and Off-Site Disposal, and Alternative 5, Excavation and On-Site Treatment, would be less protective of human health while the soil is being excavated and handled. However, the soil would be removed or treated, thereby eliminating any threat to future exposure. The potential for air emissions during on-site soil treatment makes Alternative 5 somewhat less protective of human health and the environment than off-site disposal. Alternative 4 would not be protective of human health and the environment due to it not being effective in reducing PCB concentrations in soil.

Compliance With ARARs

All alternatives, except No Action and In-Situ Bioremediation, have the potential to comply with applicable or relevant and appropriate requirements (ARARs) as listed in Section 5.1.2. However, the off-site alternative (e.g. disposal) must be performed at a permitted facility and on-site treatment will have to meet applicable storage and treatment standards. All alternatives applying excavation would meet air quality requirements for dust emissions. Alternative 4 would not comply with ARARs due to it not being effective in reducing PCB concentrations in soil.

4.4.2 Balancing Criteria

Long-Term Effectiveness

The on-site treatment and off-site disposal alternatives would be more effective in the long term because the contaminants are destroyed or removed. Capping and disposal would not be as effective in the long term because the contaminants continue to exist, and management controls would have to be used to maintain effectiveness. The cap would require routine maintenance and inspection. In-situ bioremediation would not be effective in the long term.

Reduction of Toxicity, Mobility, and Volume Through Treatment

Only the on-site treatment alternative, Alternative 5, would reduce the toxicity, mobility, and volume of contaminants through treatment. The in-situ bioremediation alternative would not reduce the toxicity, mobility, or volume of contaminants because it is not effective (based on the treatability study). No other alternative includes treatment.

Short-Term Effectiveness

The capping alternative would be very effective in protecting human health in the short term. No action does not create short-term exposure threats; however, there would be no short-term benefit to human health or the environment. The other alternatives could create short-term exposure risks through excavation, but these risks can be mitigated through dust control procedures. The transport of contaminated soil could create an impact in the event of an accident or any spillage. In-situ bioremediation would not be effective in protecting human health.

Implementability

The alternatives can be implemented relatively quickly. The capping alternative protects human health and the environment in the shortest time frame. In addition, disposal sites are not available in Alaska but are available outside of Alaska in the continental Unites States. However, either of those alternatives could be implemented in one field season. The in-situ bioremediation alternative can not be effectively implemented at this site.

Costs

The No Action and Excavation and Off-Site Disposal alternatives have the lowest costs. Since the In-Situ Bioremediation alternative is not effective in reducing contaminant concentrations, its cost should not be considered. The Excavation and On-Site Treatment and Capping alternatives have the highest costs. The capping alternative has a requirement for ongoing operation and maintenance for 30 years which results in a higher overall cost.

4.4.3 Modifying Criteria

State Acceptance

The State of Alaska accepted the in-situ bioremediation alternative, as identified in the Proposed Plan, with the contingency to implement one of the other alternatives if the treatment test is not favorable. The results of the treatability testing show that in-situ bioremediation is not an acceptable alternative for this site. As a result, the State of Alaska accepts excavation and off-site disposal as the preferred alternative.

Community Acceptance

Based on the comments received during the public comment period, the public does not object to the selected alternative. All of the remedial alternatives, with in-situ bioremediation as the preferred alternative, were presented to the public at the Restoration Advisory Board meeting held on July 12, 1995. The Air Force informed the public that one of the other alternatives would be selected in the event that the in-situ bioremediation alternative did not prove to be effective in the treatability study. The public did not object to any of the other alternatives. Part III of this ROD summarizes public input into the selection process.

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Section 5.0
SELECTED REMEDY

The risks for soil at SD31, SD16, and Cherry Hill Ditch are considered acceptable and this resulted in no further action decisions for the soil at SD31, SD16, and Cherry Hill Ditch. These sites are available for unrestricted use. The presence of PCBs in the soil at SS21 results in an unacceptable risk and the need for remedial action.

No current receptors exist for groundwater at the base due to institutional controls. As a requirement of previously signed RODs for Elmendorf Air Force Base, institutional controls have been established to restrict the use of the shallow aquifer in the outwash plain on the base. These restrictions are enforced through the Base Comprehensive Plan. Projects and other activities are reviewed during the planning stage to ensure compliance with the Base Comprehensive Plan. In addition, construction projects and other activities also undergo an environmental review. This review helps ensure compliance with groundwater use restrictions.

The selected remedy for the PCB contamination at SS21 is Alternative 3, Excavation and Off-Site Disposal. This alternative best meets the nine CERCLA criteria. It is protective of human health and the environment and complies with ARARs. It is effective at reducing contamination at SS21 in both the short and long term, and is implementable, cost-effective, and acceptable to the public and the State of Alaska. This alternative provides an appropriate level of contaminant removal to reduce risks and comply with ARARs.

The specific components of the selected remedy consist of the following:

- To protect human health, a chain link fence will be used to temporarily restrict access to the contaminated soil at SS21 until the soil has been removed and disposed off-site;
- All soil with PCB concentrations in excess of 5 ppm will be excavated and shipped to a disposal facility in the lower 48 which is acceptable for disposal of CERCLA waste under the Off-Site Disposal Rule (40 CFR 300.440);
- Confirmation sampling will be performed to ensure cleanup goals have been met;
- The sampling and removal of PCB soils at SS21 is expected to be accomplished within one field season; and
- After cleanup, site SS21 soil will be available for unrestricted use. As a requirement of previously signed RODs for Elmendorf Air Force Base, institutional controls have been established to restrict the use of the shallow aquifer in the outwash plain on the base.

Alternative 3, Excavation and Off-Site Disposal was selected because it best provides the following specific benefits at OU 3:

- Excavation and off-site disposal of these soils will effectively remediate PCB-contaminated surface soils to acceptable levels (<5 ppm);
- The cleanup will be completed within one field season; and

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- After the cleanup goals are met, the site will be available for unrestricted use.

5.1 Statutory Determinations

The selected remedy satisfies the requirements under Section 121 of CERCLA to:

- Protect human health and the environment;
- Comply with ARARs;
- Be cost effective; and
- Utilize permanent solutions and alternative treatment technologies to the maximum extent practicable.

5.1.1 Protective of Human Health and the Environment

The selected remedy (excavation and off-site disposal) is protective of human health and the environment. The current points of exposure are limited to surface soil and the risks are low. Controls will protect against the potential of risk by assuring that the contaminated soils will not come in contact with people until they have been removed for disposal.

The selected remedy of off-site disposal is protective because it will reduce PCB contamination at the site to an acceptable level of risk.

5.1.2 Applicable or Relevant and Appropriate Requirements (ARARs)

The selected remedy will comply with all ARARs. The chemical-specific, action-specific, and location-specific applicable or relevant and appropriate requirements (ARARs) are as follows.

- Toxic Substances Control Act, 15 U.S.C. 2601 et seq., and 40 CFR 761.60 and 761.75(b) is applicable for the disposal of investigation derived waste from SS21. This is due to concrete with PCB levels greater than 50 ppm;
- Alaska Air Quality Control Regulation 18 ACC 50.050(f) is applicable for the selected remedy for dust suppression during the excavation of PCB impacted soil;
- Treatment, Storage, Disposal Facility Requirements for Disposal of PCBs, 40 CFR 761, Subpart D, is appropriate for the off site removal of PCB impacted soil from SS21; and
- Off Site Disposal Rule, 40 CFR 300.440 is applicable for the transportation and disposal of PCB soil from SS21.

The Safe Drinking Water Act is not an ARAR for this remedy since no further action is necessary for groundwater under the OU 3 ROD. However, it is the ARAR for the groundwater actions selected in the OU 5 ROD to protect groundwater receptors. If further action to protect groundwater is ever necessary, it will be done pursuant to the OU 5 or OU 6 RODs.

5.1.3 Cost Effectiveness

The selected remedy is significantly less expensive that the other alternatives (other than No Action). It affords overall effectiveness proportional to its costs. The on-site treatment alternative is not cost effective because it costs 450% more without increasing protectiveness. A summary of the cost for each alternative is presented in Table 4-1.

5.1.4 Utilization of Permanent Solutions and Alternative Treatment Technologies to the Maximum Extent Practicable

The USAF, the State of Alaska, and the USEPA have determined that the selected remedy represents the maximum extent to which permanent solutions and treatment technologies can be used in a cost-effective manner at OU 3. Of those alternatives that are protective of human health and the environment and comply with ARARs, the USAF, the State of Alaska, and the USEPA have determined that the selected remedy provides the best balance of tradeoffs in terms of long-term effectiveness and permanence; reduction in toxicity, mobility, or volume achieved through treatment; short-term effectiveness; implementability; cost; and the statutory preference for treatment as a principal element and considering State and community acceptance.

The off site disposal alternative is by far the most cost effective alternative while providing a good balance of short and long term effectiveness relative to the other alternatives. The off site disposal alternative does not utilize treatment, but the only effective treatment alternative for this site is very costly and does not result in a significant reduction in risk relative to excavation and off site disposal.

5.1.5 Preference for Treatment as a Principal Element

Although the selected alternative for soil relies upon off-site disposal instead of on-site treatment; the USAF, the State of Alaska, and the USEPA have determined that this remedy represents the maximum extent to which permanent solutions and treatment technologies can be used in a cost effective manner at OU 3. A treatability study for on site bioremediation was performed and the technology was not shown to be successful. The on-site treatment alternative is not cost effective as it would cost 450% more without increasing protectiveness.

5.2 Documentation of Significant Changes

Changes in this ROD from the Proposed Plan are discussed below. These changes are a logical outgrowth of the OU 3 Proposed Plan. No other significant changes have been made.

- The preferred alternative presented in the Proposed Plan (in-situ bioremediation) was found to be ineffective at reducing PCB concentrations in the soil at SS21 and therefore cannot be the selected alternative. The preferred alternative is excavation and off site disposal.

- The contingency alternative in the Proposed Plan was on site treatment of the PCB contaminated soil. The additional sampling conducted at SS21 in 1996 further defined the area impacted by PCBs. This lead to a lower cost for the alternative of excavation and off site disposal. This resulted in this alternative being chosen instead of on site treatment.

- The description of the selected alternative (Excavation and Off-Site Disposal) in the Proposed Plan included excavation and stockpiling of the entire area at SS21 (640 cubic yards). The additional sampling conducted at SS21 in 1996 further defined the area impacted by PCBs. The revised alternative is more cost effective and more protective of human health and the environment by reducing the volume of soil to be excavated and sent for off-site disposal from 640 to 200 cubic yards and eliminates the need for on-site stockpiles.

- The Proposed Plan noted a cleanup goal of 1 ppm PCBs. This was based on EPA superfund guidance for PCB impacted soil. In order to determine a site specific cleanup level for PCBs at

SS21, a risk evaluation was performed on the PCB soil. Using site conditions, a cleanup level of 5 ppm PCBs was determined to be comparable to the EPA standard default risk of 1 ppm. This means that if SS21 contains less than 5 ppm PCBs, the site will be available for unrestricted use. The cleanup level for PCBs at SS21 will be 5 ppm PCBs as specified in Section 5.0 of this ROD.

PART III.
RESPONSIVENESS SUMMARY

Public Input into the OU 3 Selected Remedy

The primary avenues of public input have been through the Proposed Plan and public comment period. The Proposed Plan for OU 3 was issued to the public on June 19, 1995. The public comment period was from June 20 through July 21, 1995. To encourage public comment, the USAF inserted a pre-addressed comment form in distributed copies of the Proposed Plan. The comment forms were also distributed at the July 12, 1995, public meeting, held at the University of Alaska in Anchorage.

The public meeting to receive comments on the Proposed Plan was attended by 37 people, including 13 representatives from the Restoration Advisory Board (RAB). Oral comments were received at the meeting. Prior to the conclusion of the public comment period, one written comment was submitted.

All comments received are documented in the administrative record file for the site. A transcript of the public meeting is available for public review at the site information repositories. The repositories are located at the Bureau of Land Management's Alaska Resources Library and the University of Alaska Anchorage's Consortium Library. Public comments, relevant to OU 3 and / or the environmental restoration program at Elmendorf AFB, are presented below and have been paraphrased for clarity. This ROD is based on the documents in the Administrative Record and comments received from the public.

Response to Written Public Comment:

Public Comment: Agreement with the selected alternative of treating the PCB-contaminated soil at SS21 with bioremediation was expressed in a letter to the base.

USAF Response: A treatability study performed in 1996 indicated that bioremediation would not be effective in reducing PCB levels. The selected alternative is excavation and transportation of soil greater than 5 ppm PCBs to a USEPA-approved disposal facility.

Response to Oral Public Comments:

Public Comment 1: When the treatability study is performed, are efforts going to be made to simulate actual field conditions? If so, how will this be done?

USAF Response: Yes, efforts were made to duplicate field conditions. The same soil types were used. The test was conducted in the lab but did duplicate the same conditions as in the field (e.g., temperature and soil conditions).

Public Comment 2: How long will the treatability study take?

USAF Response: The treatability test was conducted from February through May of 1996 (approximately 90 days).

Public Comment 3: Has the technology been tested in Alaska?

USAF Response: Not that we are aware of. This was the first time it was tested for use in Alaska.

Public Comment 4: Are you going to try to thermally cycle the treatability like it would be in its natural, in-situ situation? In other words, long sunlight exposure?

USAF Response: We kept the soil at a constant temperature, the mean average soil temperature in summer in the Anchorage area. We did not simulate long sunlight because sunlight is not considered to have a significant impact on the effectiveness of this technology.

Public Comment 5: If for some reason bioremediation does not work, where would the soil be stored if you had to excavate?

USAF Response: The soil will not be stored but will be excavated directly into containers for shipping.

Public Comment 6: How deep are the PCBs at a dangerous level or at a level that needs to be cleaned up?

USAF Response: The average depth is approximately one foot. There are several areas that are about two-and-a-half feet. One area extends to approximately four feet.

Public Comment 7: Will you try to roto-till to that depth?

USAF Response: All of the soil with PCB concentrations above 5 ppm is present in the top six inches of soil. All of this soil will be removed.

Public Comment 8: I assume that the bioremediation must take place close to the surface so that oxygen is present.

USAF Response: The bioremediation process is both aerobic and anaerobic. Therefore, oxygen needs to be present for part of the life cycle and not for others. The soil would have been initially disturbed to bring it to the surface and then left alone for the bio-process to work.

Public Comment 9: What kinds of temperatures and resident times will be necessary to thermally treat the soil if the bioremediation does not work?

USAF Response: In order to volatilize the PCBs, it would take 850 to 900 degrees Fahrenheit. The technology is referred to as thermal desorption.

Public Comment 10: What is the total volume of contaminated soil?

USAF Response: The total volume of soil with greater than 5 ppm PCBs is 200 cubic yards.

Public Comment 11: The Proposed Plan stated that none of the OU 3 sites have large areas of elevated levels of fuel or solids (solvents?) in the soil. Therefore, the sites at OU 3 do not appear to be current sources of solvents found in the groundwater. Is it that the sites are no longer the current source or the identified sites are not the source? Will there be further contamination in the groundwater due to additional sources?

USAF Response: The sites investigated at OU 3 are believed to be the former sources of the contamination identified in the groundwater due to infiltration through the soil column. The sources have been removed but contamination remains in the shallow groundwater aquifer. We believe that there are no current sources of solvent contamination of the groundwater at OU 3. The shallow-aquifer groundwater will be monitored in the future (under other Records of Decision) to ensure that the level of contamination remains low.

Public Comment 12: It appears that the levels of groundwater contamination are decreasing. What is the time frame when you will say the contamination is removed and monitoring is no longer required?

USAF Response: Groundwater modeling performed as a part of the base wide program indicated that within 10 to 15 years the levels will decrease below any concern. A basewide program of groundwater monitoring has been developed to support RODs for OUs 1, 2, 4, and 5. Some wells at OU 3 will be included in this program and will be monitored to ensure that the levels continue to decrease to acceptable levels. Groundwater monitoring will not be a part of the OU 3 ROD. It is important to note that the current contamination levels indicate a risk of less than 10^{-5}. This is a very low risk. This assumes people are drinking and bathing with the shallow-aquifer groundwater, when in fact, this is not the case. The water is not used for any purpose.

Public Comment 13: You mentioned that the bioremediation is an innovative technology. Is this something "off the shelf"?

USAF Response: The technology has been used effectively in many parts of the world and had a reasonable chance for success in this instance. Since this alternative did not work, we will use an alternate method to remediate the soil.

Public Comment 14: What sort of levels have been treated with the bioremediation technology?

USAF Response: Levels of PCBs in the thousands of parts per million have been treated successfully at other sites.

Public Comment 15: Is this an active biological treatment or chemical enzyme?

USAF Response: It is an active biological treatment.

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APPENDIX A

OU 3 Administrative Record Index

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Table A-1

Index to OU 3 Documents in Administrative Record

Date Submitted	Document Number	Title/Subject	Author
08/30/93	025187-025289	Confirmation Notice No. 8, Installation Restoration Program, Remedial Investigation/Feasibility Study, Operable Unit 3	USAF-Elmendorf AFB
09/27/94	044375	Correspondence From The Remedial Program Manager, Elmendorf AFB, AK	USAF-Elmendorf AFB
10/03/94	044376-044377	Correspondence From U.S. EPA To Civil Engineering, Elmendorf AFB, AK	United States Environmental Protection Agency
01/21/94	034253	Engineers Discover PCB's In Soil Taken From Cherry Hill Ditch	USAF-Elmendorf AFB
07/01/93	023499-023782	Management Plan, Operable Unit 3	USAF-Elmendorf AFB
07/01/93	023783-023912	Management Plan, Operable Unit 3, Appendix A, OU3 Field Sampling Plan	USAF-Elmendorf AFB
07/01/93	023913-024277	Management Plan, Operable Unit 3, Appendix B, Quality Assurance Project Plan	USAF-Elmendorf AFB
07/01/93	024278-024393	Management Plan, Operable Unit 3, Appendix C, Site Safety And Health Plan	USAF-Elmendorf AFB
07/01/93	024394-024517	Management Plan, Operable Unit 3, Appendix D, Historical Analytical Results, Risk Based Concentrations Calculations, And Toxicity Assessments	USAF-Elmendorf AFB
03/01/95	045850-046468	Operable Unit 3 Remedial Investigation/Feasibility Study Report	USAF-Elmendorf AFB
03/01/95	046469-046499	Operable Unit 3 Remedial Investigation/Feasibility Study Report, Appendix A: Aquifer Test Data	USAF-Elmendorf AFB
03/01/95	046500-046553	Operable Unit 3 Remedial Investigation/Feasibility Study Report, Appendix B: Historical And Other Supporting Data	USAF-Elmendorf AFB
03/01/95	046554-046821	Operable Unit 3 Remedial Investigation/Feasibility Study Report, Appendix C: Background Data - Statistics	USAF-Elmendorf AFB

Table A-1

(Continued)

Date Submitted	Document Number	Title/Subject	Author
03/01/95	046822-046829	Operable Unit 3 Remedial Investigation/Feasibility Study Report, Appendix D: Fate & Transport	USAF-Elmendorf AFB
03/01/95	046830-047032	Operable Unit 3 Remedial Investigation/Feasibility Study Report, Appendix E: Seismic Data - Geophysical	USAF-Elmendorf AFB
03/01/95	047033-047170	Operable Unit 3 Remedial Investigation/Feasibility Study Report, Appendix F: QA/QC Results Summary	USAF-Elmendorf AFB
03/01/95	047171-047238	Operable Unit 3 Remedial Investigation/Feasibility Study Report, Appendix G: Field QC Data	USAF-Elmendorf AFB
03/01/95	047239-047326	Operable Unit 3 Remedial Investigation/Feasibility Study Report, Appendix H: Field Logs (Soil Boring Logs, Groundwater Monitoring Well Logs)	USAF-Elmendorf AFB
03/01/95	047837-047336	Operable Unit 3 Remedial Investigation/Feasibility Study Report, Appendix I: Geotechnical Results	USAF-Elmendorf AFB
03/01/95	047337-047368	Operable Unit 3 Remedial Investigation/Feasibility Study Report, Appendix J: Chemistry Appendix	USAF-Elmendorf AFB
03/01/95	047369-047396	Operable Unit 3 Remedial Investigation/Feasibility Study Report, Appendix K: Groundwater Monitoring Well Completion Logs	USAF-Elmendorf AFB
03/01/95	047397-047406	Operable Unit 3 Remedial Investigation/Feasibility Study Report, Appendix L: Survey Data	USAF-Elmendorf AFB
03/01/95	047407-047436	Operable Unit 3 Remedial Investigation/Feasibility Study Report, Appendix M: Waste Management Appendix	USAF-Elmendorf AFB
03/01/95	047437-047700	Operable Unit 3 Remedial Investigation/Feasibility Study Report, Appendix N: Risk Assessment Tables	USAF-Elmendorf AFB
03/01/95	047701-048018	Operable Unit 3 Remedial Investigation/Feasibility Study Report, Appendix O: Field Log Location Forms	USAF-Elmendorf AFB

Table A-1

(Continued)

Date Submitted	Document Number	Title/Subject	Author
03/01/95	048019-048126	Operable Unit 3 Remedial Investigation/Feasibility Study Report, Appendix P: Well Development Logs	USAF-Elmendorf AFB
03/01/95	048127-048149	Operable Unit 3 Remedial Investigation/Feasibility Study Report, Appendix Q: Base Water Study Data	USAF-Elmendorf AFB
03/01/95	048150-048779	Operable Unit 3 Remedial Investigation/Feasibility Study Report, Appendix R: Laboratory Data	USAF-Elmendorf AFB
03/01/95	048780-04806	Operable Unit 3 Remedial Investigation/Feasibility Study Report, Appendix S: Reconstruction of Cherry Hill Ditch	USAF-Elmendorf AFB
03/01/95	048807-049743	Operable Unit 3 Remedial Investigation/Feasibility Study Report, Appendix T: Sample Logs	USAF-Elmendorf AFB
03/01/95	049744-049977	Operable Unit 3 Remedial Investigation/Feasibility Study Report, Appendix U: Chain Of Custody Records	USAF-Elmendorf AFB
03/01/95	049978-050025	Operable Unit 3 Remedial Investigation/Feasibility Study Report, Appendix V: Cost Detail And Cost Sensitivity Backup	USAF-Elmendorf AFB
03/01/95	050026-052131	Operable Unit 3 Remedial Investigation/Feasibility Study Report, Attachment To Appendix F	USAF-Elmendorf AFB
03/01/95	052132-052543	Operable Unit 3 Remedial Investigation/Feasibility Study Report, Attachment To Appendix M	USAF-Elmendorf AFB
06/15/95	052670-052685	Elmendorf Air Force Base OU3, The Proposed Plan for Remedial Action	USAF-Elmendorf AFB
9/16/96	062053-062065	Operable Unit 3 Record of Decision Comments	USEPA
9/96	062066-062083	Response to Comments USEPA, Draft Final Record of Decision	USAF-Elmendorf AFB
9/96	062084-062086	ADEC Letter regarding Draft Final Record of Decision	ADEC

Table A-1

(Continued)

Date Submitted	Document Number	Title/Subject	Author
9/96	062087-062090	Response to ADEC Comments, Draft Final Record of Decision	USAF-Elmendorf AFB
9/96	062091-062095	USAF Memo, Cost Estimates for OU 3 Alternatives	USAF-Elmendorf AFB
6/95	062096	Public Written Comment, OU 3 Proposed Plan	Public
9/96	062097-062139	SS21 Biotreatability Testing of PCB-Contaminated Materials, Final Report	USAF-Elmendorf AFB
Various	062140-062141	Public Notices for OU 3	USAF-Elmendorf AFB

APPENDIX B

COPCs in Soil and Groundwater

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Table B-1

Contaminants of Potential Concern (COPCs) in Soil Evaluated in the OU 3 Risk Assessment

Inorganic Analytes		**Organic Analytes**				
SD52						
Surface Soils						
Arsenic	Manganese	1,2,4-Trichlorobenzene	Anthracene	Chrysene	Ethylbenzene	Naphthalene
Calcium	Molybdenum	2-Methylnaphthalene	Benzo(a)anthracene	Dibenz(a,h)anthracene	Fluoranthene	PCB-1260
Chromium	Nickel	4-Methylphenol	Benzo(a)pyrene	Dibenzofuran	Fluorene	Phenanthrene
Copper	Potassium	4,4'-DDD	Benzo(b)fluoranthene	Dieldrin	Heptachlor	Phenol
Lead	Selenium	4,4'-DDE	Benzo(g,h,i)perylene	Diesel	Heptachlor epoxide	Pyrene
Magnesium	Zinc	4,4'-DDT	Benzo(k)fluoranthene	Di-n-butyl phthalate	Hydrocarbons	Total Xylenes
		Acenaphthylene	Benzoic acid	Endosulfan I	Indeno(1,2,3-cd)pyrene	gamma-BHC
		Acenaphthene	Benzyl alcohol	Endosulfan II	Kerosene	delta-BHC
		Aldrin	bis(2-Ethylhexyl)phthalate	Endrin	Methylene chloride	alpha-BHC
			Butylbenzylphthalate	Endrin aldehyde		
Subsurface Soils						
Arsenic	Manganese	4,4'-DDD	Acetone	Butylbenzylphthalate	Hydrocarbons	Pyrene
Aluminum	Molybdenum	4,4'-DDE	Benzo(a)anthracene	Chlorobenzene	Indeno(1,2,3-cd)pyrene	Toluene
Barium	Potassium	4,4'-DDT	Benzoic acid	Dibutylphthalate	Methylene chloride	alpha-BHC
Beryllium	Selenium	4-Methylphenol	Benzo(g,h,i)perylene	Heptachlor epoxide	PCB-1260	m & p-Xylene
Calcium	Thallium		2-Butanone (MEK)			
Cyanide	Vanadium					
Lead	Zinc					
West Intersource Area (MW24)						
Subsurface Soils						
Antimony	Selenium	Benzo(a)anthracene	Benzo(b)fluoranthene	Chrysene	Phenanthrene	Pyrene
Arsenic	Thallium	Benzo(a)pyrene	Benzo(k)fluoranthene	Fluoranthene		
Lead	Cyanide					
Molybdenum	Mercury					

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Table B-1

(continued)

Inorganic Analytes		Organic Analytes				
SD16						
Surface Soils						
Arsenic	Magnesium	2-Methylnaphthalene	Acenaphthylene	Benzo(b)fluoranthene	Dibenz(a,h)anthracene	Indeno(1,2,3-cd)pyrene
Barium	Manganese	4,4-DDD	Acetone	Benzo(g,h,i)perylene	Dibenzofuran	Naphthalene
Calcium	Molybdenum	4,4'-DDE	Anthracene	Benzo(k)fluoranthene	Ethylbenzene	Phenanthrene
Chromium	Nickel	4,4'-DDT	Benzo(a)anthracene	Butylbenzylphthalate	Fluoranthene	Phenol
Cobalt	Potassium	Acenaphthene	Benzo(a)pyrene	Chrysene	Fluorene	Pyrene
Copper	Selenium	Endrin	Heptachlor epoxide	Methylene chloride	Toluene	Xylenes
Cyanide	Zinc	Benzoic acid	Di-n-butyl phthalate	bis(2-ethylhexyl)phthalate	delta-BHC	
Lead						
Subsurface Soils						
Aluminum	Lead	2-Butanone (MEK)	Benzo(b)fluoranthene	Dibenz(a,h)anthracene	Gasoline	Phenanthrene
Arsenic	Molybdenum	2-Methylnaphthalene	Benzoic acid	Dibenzofuran	Hydrocarbons	Pyrene
Barium	Selenium	Acenaphthene	Benzo(g,h,i,)perylene	Di-n-butylphthalate	Indeno(1,2,3-cd)pyrene	Toluene
Beryllium	Silver	Anthracene	Benzo(k)fluoranthene	Fluoranthene	Methylene chloride	Trichloroethene
Calcium	Vanadium	Benzo(a)anthracene	Butylbenzylphthalate	Fluorene	Naphthalene	Xylene (total)
Copper	Zinc	Benzo(a)pyrene	Chrysene			
	Cyanide					
SS21						
Surface Soils						
Arsenic	Manganese	2-Methylnaphthalene	Benzo(a)anthracene	Dibenzofuran	Heptachlor	PCB-1260
Calcium	Molybdenum	4,4'-DDD	Benzo(a)pyrene	Dieldrin	Heptachlor epoxide	Phenanthrene
Chromium	Nickel	4,4'-DDE	Benzo(b)fluoranthene	Di-n-butylphthalate	Hydrocarbons	Pyrene
Copper	Potassium	4,4'-DDT	Benzo(g,h,i)perylene	Endosulfan I	Indeno(1,2,3-cd)pyrene	Toluene
Cyanide	Selenium	Aldrin	Benzo(k)fluoranthene	Endosulfan II	Naphthalene	Xylene (total)
Lead	Zinc	Anthracene	Chrysene	Endrin	PCB-1016	gamma-BHC
Magnesium			Dibenz(a,h)anthracene	Fluoranthene		

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Table B-1

(continued)

Inorganic Analytes		**Organic Analytes**				
SS21						
Subsurface Soils						
Aluminum	Lead	1,2,4-Trichlorobenzene	Benzo(a)anthracene	Dibenzofuran	Heptachlor	PCB-1260
Arsenic	Molybdenum	2-Methylnaphthalene	Benzo(a)pyrene	Dibutylphthalate	Heptachlor epoxide	Pyrene
Calcium	Selenium	4,4'-DDD	Benzo(b)fluoranthene	Dieldrin	Hydrocarbons	Toluene
Copper	Vanadium	4,4'-DDE	Benzo(g,h,i)perylene	Endosulfan I	Indeno(1,2,3-cd)pyrene	Trichloroethene
Cyanide	Zinc	4,4'-DDT	Benzoic acid	Endosulfan II	Methylene chloride	Xylene (total)
		Aldrin	Benzo(k)fluoranthene	Endrin	Naphthalene	alpha-BHC
		Anthracene	Butylbenzyl phthalate	Endrin aldehyde	PCB-1016	delta-BHC
			Chrysene	Fluoranthene	Phenanthrene	
East Intersource Area (MW25)						
Surface Soils						
Antimony	Molybdenum	2-Methylnaphthalene	Benzo(a)pyrene	Benzo(k)fluoranthene	Dibutylphthalate	Naphthalene
Arsenic	Selenium	Anthracene	Benzo(b)fluoranthene	Chrysene	Fluoranthene	Phenanthrene
Cyanide	Thallium	Benzo(a)anthracene	Benzo(g,h,i,)perylene		Indeno(1,2,3-cd)pyrene	Pyrene (3
Lead						

Table B-2

Contaminants of Potential Concern (COPCs) in Groundwater Evaluated in the OU 3 Risk Assessment

Inorganic Analytes		Organic Analytes				
OU 3 West Groundwater Area						
Aluminum	Potassium	1,1,2-Trichloroethane	4-Methyl-2-pentanone (MIBK)	Chloroform	Trichloroethene	Xylene (total)
Cadmium	Vanadium	1,1-Dichloroethene	Benzene	Chloromethane	Trichlorofluoromethane	cis-1,2-Dichloroethene
		2-Hexanone	Carbon tetrachloride	Ethylbenzene	Toluene	cis-1,3-Dichlorpropene
				bis(2-Ethylhexyl)phthalate		
OU 3 East Groundwater Area						
Aluminum		1,1,1-Trichloroethane	Benzene	Diesel	Toluene	bis(2-
Cadmium	Potassium	1,1-Dichloroethane	Carbon tetrachloride	Ethylbenzene	Trichloroethene	Ethylhexyl)phthalate
Cyanide	Vanadium	1,2-Dichloroethane	Chloroform	Fluorene	Trichlorofluoromethane	cis-1,2-Dichloroethene
		1-Chlorohexane	Chloromethane	Tetrachloroethene	Xylenes (total)	cis-1,3-Dichloropropene
						trans-1,2-Dichloroethene

ACRONYM LIST

ADEC	=	Alaska Department of Environmental Conservation
AFB	=	Air Force Base
ARARs	=	Applicable or Revelant and Appropriate Requirements
BTEX	=	Benzene, Toluene, Ethylbenzene, Xylene
CSFs	=	Cancer Slope Factors
CERCLA	=	Comprehensive Environmental Response, Compensation, and Liability Act of 1980
COC	=	Contaminant of Concern
COPC	=	Contaminant of Potential Concern
DCE	=	Dichloroethene
ELCR	=	Excess Lifetime Cancer Risk
ERA	=	Ecological Risk Assessment
EQ	=	Ecological Quotient
FFA	=	Federal Facilities Agreement
FS	=	Feasibility Study
HEAST	=	Health Effects Assessment Summary Tables
HDPE	=	High Density Polyethylene
HI	=	Hazard Index
HRA	=	Health Risk Assessment
IRIS	=	Integrated Risk Information System
IRP	=	Installation Restoration Program
MCL	=	Maximum Contaminant Level
NCP	=	National Contingency Plan
OU	=	Operable Unit
PAH	=	Polynuclear Aromatic Hydrocarbons
PCBs	=	Polychlorinated Biphenyls
PCE	=	Tetrachloroethene
PNAs	=	Polynuclear Aromatic Hydrocarbons
RAB	=	Restoration Advisory Board
RCRA	=	Resource Conservation and Recovery Act
RfDs	=	Reference Doses
RI	=	Remedial Investigation
RME	=	Reasonable Maximum Exposure
ROD	=	Record of Decision
SARA	=	Superfund Amendments and Reauthorization Act of 1986.
SVOCs	=	Semi-Volatile Organic Compounds
TCE	=	Trichloroethene
TSCA	=	Toxic Substances Control Act
UCL	=	Upper Confidence Limit
USAF	=	U.S. Air Force
USEPA	=	U.S. Environmental Protection Agency
USGS	=	U. S. Geological Survey
VOCs	=	Volatile Organic Compounds

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